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Bell Telephone MAGAZINE

Communication Sets Its Sights Ahead
HAROLD S. OSBORNE

Cooperative Leadership toward a Common Objective
JUDSON S. BRADLEY

The Bell System's Best Sellers • A. B. COVEY

On Being a Responsible Individual • CLEO F. CRAIG

Noted Old LD Lines Are Finally Retiring
RICHMOND B. WILLIAMS

American Telephone & Telegraph Company · New York

Bell Telephone Magazine

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A Medium of Suggestion & A Record of Progress

Judson S. Bradley, *Editor.* *Published four times a year for the supervisory forces of the Bell System by the Public Relations Department of the*
American Telephone and Telegraph Co., *195 Broadway, New York 7, N. Y.*
Cleo F. Craig, *President;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

Who's Who & What's What

in This Issue

THE FIRST CONTRIBUTION that HAROLD S. OSBORNE made to this publication was "Standardization in the Bell System," and it appeared in the old BELL TELEPHONE QUARTERLY in the issues for January and April 1929. The article which begins two pages over, twenty-three years later, is the last of many. For Harold Osborne, Chief Engineer of the American Telephone and Telegraph Company since 1943, retires on August 31, after 42 years of Bell System service. Joining the A. T. & T. Co. in 1910, in the then Transmission and Protection Department, he was assistant to the transmission and protection engineer from 1914 to 1920 and then transmission engineer until 1939. He was operating results engineer 1939–1940, plant engineer 1940–1942, and in the latter year he became assistant chief engineer.

Mr. Osborne's "extra-curricular" activities are too extensive even to list here. Mention should be made, nonetheless, of his services to the Federal Government in various advisory capacities; of his long association with the American Institute of Electrical Engineers, of which he was president in 1942–1943; and of his part in the American Standards Association. He has been president since 1949 of the U. S. National Committee of the International Electrotechnical Commission, and sails abroad soon to be installed as president of the parent International Commission—the third American to occupy the office. A testimonial which certain of his associates presented to Mr. Osborne last February is reproduced on the opposite page.

AFTER SEVERAL YEARS of editorial and publishing activity, JUDSON S. BRADLEY joined the Information Department of the Southern New England Telephone Company in 1925 as copy manager, and was later made advertising manager. In 1928 he transferred to the A. T. & T. Co. in New York. A member of the Public Relations Department there since 1930, he has been closely

Harold S. Osborne

Judson S. Bradley

A. B. Covey

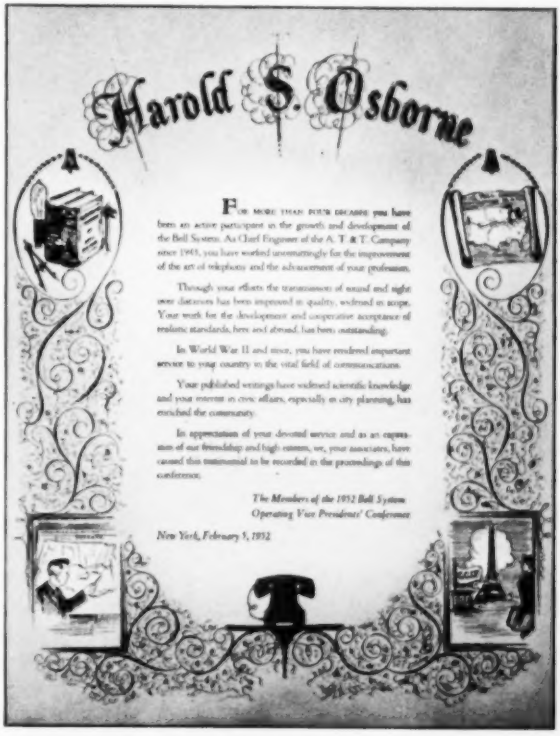
Richmond B. Williams

associated with this publication for 20 years, and has been its editor since 1943.

SINCE THE LATTER PART of 1951, A. B. COVEY has been coördinating the activities of the special group of Associated Company Plant and Engineering men about whom he writes in "The Bell System's Best Sellers," which begins on page 87. He joined the Southwestern Bell Telephone Company in 1923, and during the next four years held assignments in the General Engineering Department. In 1927 he became transmission and protection engineer of the Western Missouri and Kansas Area. Three years later he was made acting outside plant engineer. In 1930 he transferred to the Plant Engineering Division of the A. T. & T. Co.'s O. and E. Department, where he held various assignments in the transmission section. He has been associated with the defense activities section since 1951.

A PICTURE OF and note about President CLEO F. CRAIG will be found on page 77.

WITH THE Long Lines Department since 1926, RICHMOND B. WILLIAMS has held various responsibilities since that time—including that of editor of *Long Lines Magazine*. During World War II he was a member of the House Magazine Advisory Committee of the War Finance Staff of the U. S. Treasury Department, and in 1943 was chairman of the War-Time Conference of the National Council of Industrial Editors Association held in New York. Mr. Williams' previous contribution—"TR Receives His Summons to the Presidency"—which appeared in this MAGAZINE for Autumn 1951, aroused a good bit of interest among historians and others interested in that era, and copies have been placed in the archives of the Theodore Roosevelt Memorial Association, the New-York Historical Society, and those of the State Historian of the State Educational Department in Albany, N. Y.


Harold S. Osborne

FOR MORE THAN FOUR DECADES you have been an active participant in the growth and development of the Bell System. As Chief Engineer of the A. T. & T. Company since 1949, you have worked unremittingly for the improvement of the art of telephony and the advancement of your profession.

Through your efforts the transmission of sound and sight over distances has been improved in quality, widened in scope. Your work for the development and cooperative acceptance of realistic standards, here and abroad, has been outstanding.

In World War II and since, you have rendered important service to your country in the vital field of communications.

Your published writings have widened scientific knowledge and your interest in civic affairs, especially in city planning, has enriched the community.

In appreciation of your devoted service and as an expression of our friendship and high esteem, we, your associates, have caused this testimonial to be recorded in the proceedings of this conference.

The Members of the 1952 Bell System Operating Vice Presidents' Conference

New York, February 5, 1952

This testimonial was accompanied by the signatures of forty-seven of Mr. Osborne's associates

"Radio Relay" in the 1830s: The semaphore on Staten Island, N. Y., in a setting drawn by the younger Cruikshank—an Englishman who obviously had never been there. *See the article beginning on the opposite page*

Many Factors, Including the Form of Organization of the Bell System, Combine to Stimulate the Continued Growth And Development of Telephone Service in This Country

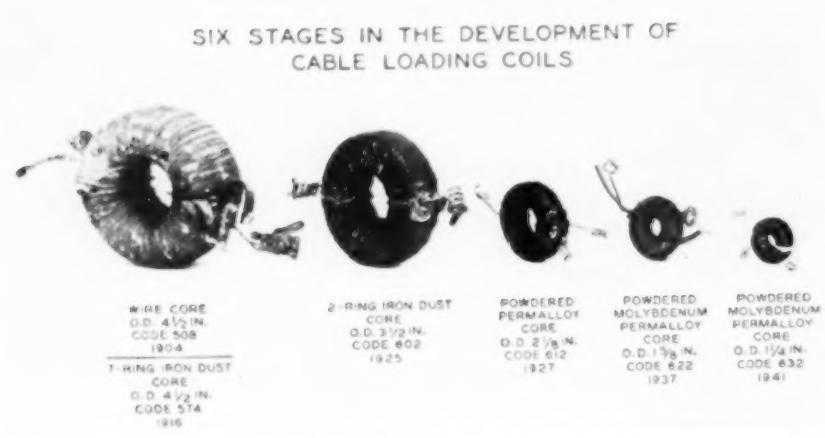
Communication Sets Its Sights Ahead

Harold S. Osborne

IN THE three-fourths of a century since the invention of the telephone, electrical communication has had a truly astonishing growth and development. In this country alone, there are not far short of 50 million telephones in service. The number of telephone conversations carried out among them each day is reaching toward the 200-million-mark. The telephone has become an essential tool of all business and industry. Seventy percent of all the homes in the country are equipped with it. As more people have telephone service, more people need it and use it. It continues to become more and more an integral part of all aspects of the national life.

Is it not possible, then, that electrical communication has become a mature art, in which we may expect future growth and modification but no extraordinary and transforming developments?

A prediction of this sort on a broader base was made in the report on "Industrial Depressions" published by the Commissioner of Labor in 1886, which presented the results of a careful economic study by representatives of the Federal Government. After pointing out that the necessary railroads had been built and that the economic tools in America and in Western Europe had been brought fully up to date, he concludes, "It is true that the discovery of new processes of manufacture will undoubtedly continue . . . but this will not leave room for a marked extension such as has been witnessed during the past fifty years or afford a remunerative employment for the vast amount of capital which has been created during that period. . . . There may be room for further intensive, but not extensive, development of industry in the present era of civilization."


SIX STAGES IN THE DEVELOPMENT OF CABLE LOADING COILS
WIRE CORE O.D. 4½ IN. CODE 508 1904
T-RING IRON DUST CORE O.D. 4½ IN. CODE 574 1915
2-RING IRON DUST CORE O.D. 3½ IN. CODE 602 1925
POWDERED PERMALLOY CORE O.D. 2⅛ IN. CODE 612 1927
POWDERED MOLYBDENUM PERMALLOY CORE O.D. 1⅝ IN. CODE 622 1937
POWDERED MOLYBDENUM PERMALLOY CORE O.D. 1¼ IN. CODE 632 1941

This array of loading coils tells its own story

Today we are less likely to make such a serious mistake. The whirlwind rate of development of new scientific knowledge and its application has given us the habit of expecting new marvels in rapid succession.

One of the reasons for the continuing growth and development of the telephone system is that telephone service continues to become a better bargain.* It is cheaper in terms of hours of work. For example, the skilled workman who in 1940 had to work four hours to earn enough to pay his monthly telephone bill can pay it today with earnings of about two hours' work. As a result, more and more people feel that they cannot afford to be without telephone service in the home, and the extent of its use in business and industry is continually expanded. The indications are that this is a long-term trend, and will continue to stimulate the future development of the telephone system.

* See "The Telephone Looks to the Future," MAGAZINE, Spring 1952.

In addition to the economic trends, there are other technical and general trends of our national life which work toward the continued development of electrical communications, both in amount and in variety. In the long range, these general trends will have a great effect on the continued development of the telephone system.

a. The art of electrical communication continues to be developed rapidly.

b. Increased amounts and new kinds of communication service continue to be needed to meet the requirements of our rapidly developing social and industrial structure.

Development of the Art of Electrical Communication

THE INCREASE in the possibilities of electrical communication, due to the increase in technical knowledge and the development of new things, is

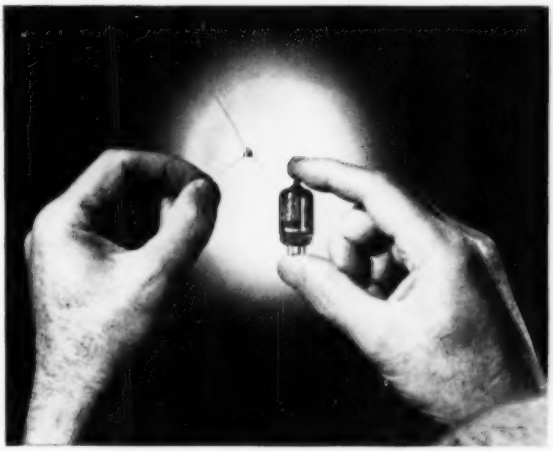
rapid and extends through many fields.

The development of the art comes about in part through the use of new materials, which are appearing with increasing frequency in this chemical age. For an example, consider the wonderful plastic *polyethylene*. While polyethylene has many uses in the telephone system, a striking illustration is its employment as a substitute for lead in the sheathing of telephone cables. This development alone made possible, right after the war, the rapid building up of manufacture of telephone cables to a level meeting the requirements of the Bell Telephone Companies: to a volume of 12 million miles of wire in cable in one year. With experience in its design, manufacture, and use, it is proving to have other advantages in many cases because of light weight and freedom from corrosion.

A quite different type of material fundamental to modern telephone systems is those ferrous alloys used to carry the magnetic field in myriad types of equipment. Iron was formerly used for this purpose. The Bell Telephone Laboratories over the years have developed new alloys of iron, nickel, and, in smaller quantities, molybdenum and other metals, which have extraordinarily improved magnetic properties. The bulk of certain types of loading coil, for example, has been reduced by 20 to 1 for the same use.

This is one illustration of a trend toward smaller and smaller volume in the development of modern communication equipment. This also helps to hold down costs, both because smaller quantities of material are required and because of the smaller space required to house the millions of pieces of apparatus necessary in a modern automatic telephone exchange or toll office.

The new materials help to make practicable new types of devices which heretofore were impracticable. For example, the transistor, a great invention resulting from extensive scientific research, makes use of the metal germanium, which is not new to science but is relatively new to industry. In its present form, it consists of a tiny piece of this metal which has first been purified to an extremely high degree and then subjected to the introduction of carefully controlled impurities of different types and amounts. The tiny



The tiny plastic bead of the transistor contrasts with the famed "peanut" (6AK5) vacuum tube

piece enclosed in the plastic bead shown in the photograph has three sections, containing different types of impurity, and a wire connected to each of the three sections. This remarkable midget, connected with suitable circuits and modest sources of power, will amplify, modulate, or generate with extraordinary efficiency and economy the electrical currents required for communication. It seems destined to revolutionize a good deal of the construction and design of electronic devices.

New Systems of Communication

THE PROCESSES of invention and development weld many of the new devices, along with many pieces of apparatus and devices previously available, into new methods and systems for giving communication service. The influence of these new communication systems on the development of telephone service is marked.

One of the striking modern developments is the great extension of multiplex systems of transmission. The most recent of these "carrier" systems provides for transmission of 1,800 telephone conversations over one pair of conductors (in one direction) by use of different frequencies stacked closely together on the same conductors. This system is applied to the coaxial cable, and gives the ordinary coaxial cable having eight coaxial units a capacity for 5,400 telephone circuits—even after allowing for the assignment of one pair of coaxial units as reserve.

A second type of facility transmitting a broad band of frequencies and having a great capacity for multiplex operation is the radio relay. Beams of radiant energy using frequencies of four billion cycles and employing antenna horns and lenses ten feet square are sharply focused from tower to tower 25 or 30 miles apart. At the present time each radio channel has a capacity comparable with that of the L-1 coaxial cable system: 600 telephone circuits. This is sure to be increased with the further development of this remarkable new transmission system. Already 650,000 miles of telephone circuit are provided by this system, and its use is expanding rapidly.

Techniques are being developed for the use of still higher frequencies for electrical communication. Experience today indicates, however, that when the frequency is pushed very much above ten billion cycles, the interference with transmission by rain and other atmospheric conditions increases rapidly. We quickly approach the limitations of the transmission of light itself. For still higher frequencies, therefore, it seems probable that it will be necessary to provide our own atmosphere. This can be done with what are called wave guides: i.e., hollow tubes like a coaxial unit with the central conductor omitted. Wave guides are already widely used for short distances in the apparatus of radio relay systems and of radars and other applications of the current ultra-high-frequency technique. They show promise of becoming the superhighways of communication of tomorrow—highways which will accommodate on each channel telephone circuits by the thousands rather than by the hundreds.

A special case of long distance telephone and telegraph transmission is

presented by overseas transmission to the other continents of the globe. The present method of giving service, primarily by high-frequency radio channels, has served excellently for the establishment of the service and its development during the past 25 years. Now this method is rapidly being outgrown, both in the amount of service demanded and in the quality of service—which is increasingly important because of the growing dependence on this form of communication by government, industry, and individuals. For the long look ahead, it is safe to say that new techniques will be developed which will release this service from the limitations of the present transmission method.

A good deal of progress has been made in one direction: namely, in the design of a telephone cable, equipped at frequent intervals with telephone repeaters, laid at the bottom of the sea and capable of transmitting numbers of telephone messages simultaneously through a pair of cables. The design of telephone repeaters which can be spliced into such a cable, which will survive the rugged service conditions of submarine cables, and which will operate for decades without requiring any maintenance, involves formidable technical difficulties. Such repeaters, however, are now in service on a cable between Key West, Fla., and Havana, Cuba, operating in water 6,000 feet deep. So far, in their first two years of life, they have given very satisfactory performance.

Development of Switching Systems

ALONG WITH the development of transmission systems, there have been —and are continuing—equally re-

The Bell System's current 25,000 miles of television channels in service are rapidly being expanded to twice that mileage

Bell System mobile telephone service is or will be furnished through special equipment in the cities indicated

markable developments in switching systems.

The use of automatic machinery for the switching of local calls has long been recognized as an economic and service objective, and has been extended to 80 percent of the telephones of the Bell System. Dial systems, as they are called, are complicated, and they constitute an increasingly important part of the equipment used in giving telephone service. Great strides forward have been made in recent years through the development of crossbar systems. Electronic systems of switching are the subject of active research. For the long pull, it seems safe to predict that great changes and improvements will come out of the research effort which is being applied to this important subject.

Today the Bell System Companies are proceeding rapidly with the extension of dial methods of operation of long distance calls—even on a country-wide basis. Some time ago a fundamental plan was developed by which a toll operator at any point will be able to complete long distance calls to any other point in this country or in Canada directly by automatic machinery without requiring the attention of operators at other points. The Bell System is well on the way to putting this into effect. At the present time, more than one-third of all toll board calls are handled in this way.

The central core of this system is the No. 4-type toll switching system, of which possibly 85 will be required for the complete nation-wide service and of which 16 are now in service. The first 4-A systems containing all of the features

required for the nation-wide plan will be placed in service in Scranton, Penna., and Newark, N. J., early next year. These switching systems, when the plan is fully effective, will, when a call is placed, receive a 7-digit or a 10-digit number representing any telephone in the country and proceed with all of the operations necessary to complete the call.

The formulation of the plan of which this forms a part has required years of coördinated planning and study by the telephone companies throughout the country to provide for a national toll numbering system, toll switching and routing plans, and to determine specifically the functions which the 4-A systems must be capable of performing in order that the entire nation-wide system can work with efficiency and economy.

A remarkable feature of this development is a further improvement in the speed of long distance service because of the great speed with which the machine can make connections, test routes for available circuits, shift over to alternative routes, and find its way through the great dial network of the country to the called telephone number.

WHILE proceeding rapidly with arrangements for nation-wide dialing by the operator, the plan has contemplated from the start that nation-wide customer dialing would ultimately be provided. With this in view, the 10-digit national numbering plan is based upon the local telephone numbers, with the addition of a minimum number of digits to represent the geographical area to which the call is directed.

When the customer instead of the operator is to dial through to the desired telephone, an important added requirement is involved. With customer dialing, the machine must make automatically a record of all the details of the call upon which charges are based—a record which otherwise is made by the toll operator. Various forms of equipment to do this are now in extensive use for short-haul calls. Equipment suitable for general long-haul customer dialing is being developed.

In the meantime, a trial arrangement of long-haul customer dialing has been established in one local office: Englewood, N. J. Telephone users at Englewood can dial directly all telephones in any of eleven large city areas scattered throughout the continent from Boston to San Francisco. With this form of operation, the bell of the called telephone normally rings 15 or 20 seconds after the dialing is completed, compared with 90 seconds' average for the service given today.

The results of the Englewood trial are very encouraging. The customers are dialing 96 percent of all the calls it is possible to dial. Difficulties due to wrong numbers and other troubles are few. The new method is received with favor by the customers. It seems clear that this whole plan represents an impressive forward movement in the development of telephone service which will trend toward a continuing increase in the use of long distance service in the future.

Development of the Kinds and Quantity of Communication Needed

THE THIRD REASON for the continued development of the telephone

"Wireless Telephone": an experimental set containing a very-short-range radio, to eliminate the customary telephone cord

system mentioned at the beginning of this paper was the development of the needs of the American public.

A striking illustration of this is the current rapid development of television transmission. On September 4, 1951, the image and words of President Truman opening the international conference on the Japanese Treaty in San Francisco were brought across the country to be broadcast from the television stations throughout the East. This marked the inaugural of transcontinental television transmission facilities of the Bell System. The broad band systems, coaxial cable and radio relay, which are described above, are in fact the only available types of transmission facility capable of distributing television programs to groups of broadcast stations. That is because television transmission requires a very broad band transmission channel, comparable with that required for 600 one-way telephone channels.

The Bell System television transmission network now aggregates 25,000 miles of channel in service, and is rapidly being expanded to twice that mileage. Television is growing so fast that its future seems very promising. For some time, the number of television broadcasting stations in service was frozen at about 100 by the Federal Communications Commission. Recently the restriction has been lifted, and in the months ahead the Commission will probably grant many of the applications for additional stations now before it, more than 500 in number. More frequencies have been made available for television broadcasting, so that, in some cases, there may be as many as 10 channels available in a single area.

There is evidence that the field of television ultimately will include many activities beside broadcasting. The motion picture industry is working hard on its relation to television, and can be expected either to use television as a part of the theater program on large screens or to develop a large output of motion pic-

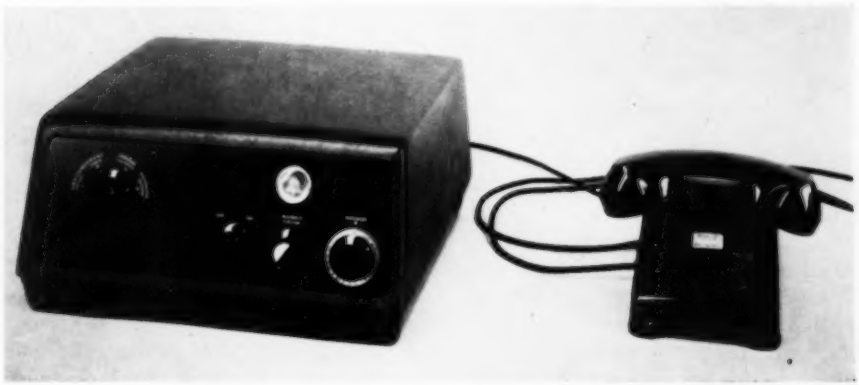
tures suitable for television, or both. Color systems are being developed. Attention is being given to the use of television for educational purposes and also for a wide variety of business and military purposes. The telephone companies are actively cooperating in these movements and propose to be in a position to provide networks to distribute programs to groups of theaters, to provide for color, and take care of any other developments which may be brought forth.

Mobile Service

THE EXPANSION of telephone service to various kinds of mobile units is another example of the development of new needs for electrical communication. A wide use is already made of telephone service to motor vehicles. Police cars, taxis, trucks, buses, and business vehicles of many kinds, totaling perhaps 250,000, now have service in one form or another. Many are private telephone systems connecting the cars with the headquarters of the organization involved. The telephone companies of the country also give a general mobile service, by which communication is established between a car and any other commercial telephone in the country. Service is now offered in 500 cities and towns to about 12,000 vehicles.

There is a rapidly growing use of radiotelephony by other kinds of mobile units. Telephony to ships, which started with ships on the high seas and along coastal waterways, is one example. Already 19,000 harbor craft and pleasure craft are equipped, including craft on rivers and lakes as well as on the oceans. General telephone service to passengers on trains is expanding, and about two dozen trains are so equipped at the present time. Telephone service is fundamental to the operational control of airplanes, and this is a private service. But in addition to this, about 350 planes have general Bell System service.

"Walkie-Talkies" practicable for short range have been developed and put to a variety of uses. It is interesting to observe that in 1940, for experimental purposes, the Bell Lab-



An answering and recording set, useful in the subscriber's absence

An experimental "distant talking" set: you would speak to it and listen to it without holding or switching anything

oratories put together a telephone set equipped with a very-short-range radio to eliminate the need for a telephone cord. You can imagine at some future time the lady of the house taking the telephone with her as she goes for a walk in the garden, and making and receiving her telephone calls there.

Auxiliaries to Telephone Service

THE EXPERIMENTAL cordless telephone set is one illustration of the fact that the development of new devices and the development of customers' needs combine to bring a continuing change in the services offered in connection with ordinary telephone usage. This is far too great a field to cover generally, but two or three illustrations of this type of development will be of interest.

For quite a long time, the telephone companies have offered, in various parts of the country, several forms of answering service; i.e., means whereby telephone calls will be answered and messages taken when the subscriber is absent. With the great improvement of automatic recording and reproducing systems, it now appears to be practicable to offer that type of service with automatic devices. The development of types of equipment suitable for this purpose is at an early stage. The experiments which we have been conducting, however, seem to indicate that this should have a field of usefulness in the future.

Looking ahead, additional auxiliary devices to meet special telephone requirements are to be expected. One example is the distant-talking set, whereby one talks and listens to a box on his desk without holding anything in his hand and without operating a switch to change from talking to listening. To provide good general service with such a device involves formidable technical difficulties, but it is to be expected that these will be overcome. Provision for conference calls has been a part of telephone service for years—that is, calls in which a group of people in various parts of the country can be connected together so that all hear what each one says. Looking forward, great improvements can be made in this service.

The inquiring mind has probably asked before this when we shall have individual television with telephone calls. Bell System people will remember the demonstration of this form of service given 25 years ago. First between 195 Broadway and the Bell Laboratories and later between New York and Washington, demonstration equipment associated with appropriate circuits enabled those conversing to see each other on tele-

vision screens while they talked. In spite of the tremendous advances in television in 25 years, there is no indication as yet when this would be a sufficiently economical service to appeal generally to telephone users.

Other Needs

So far, we have talked only of the needs for electrical communication which are already before us.

The increased complexity of our industrial organization and the rapid development of new electronic devices suggest almost unlimited future possibilities for the development of new communication needs. For example, electronic devices for computation and for other uses of data suggest that the transmission of data between the parts of a widespread commercial enterprise or an industry may become an important future element of communication needs.

Similarly, the great private-line systems, some equipped with automatic switching and with means for the storage and retransmission of messages which are now in use by a few large industries, may be the harbinger of a more general requirement for special communication systems designed to meet the specific requirements of large enterprises or groups of users in the future.

In this field, to be specific would be in the realm of pure speculation. The present development of industry, however, and of the art of communication, seems to indicate that here is a trend which may be expected to be of increasing importance in future years.

Needs of Communication by Defense Agencies

It is a remarkable thing how extensive and varied are the communication requirements of the defense agencies. Some of these are—to name but a few—communication systems for the Air Defense network, both warning and control; for anti-aircraft batteries; for Civil Defense warning and administrative net-

Former President Walter S. Gifford of A. T. & T. and Dr. Herbert E. Ives of Bell Laboratories, both now retired, take part in an early-day television demonstration

works; and for networks linking Army, Navy, and Air Force installations throughout the country. The telephone companies at the present time are providing private lines alone aggregating 500,000 miles of circuits. The variety and extent of use are rapidly increasing.

It is a fortunate thing for this country that the great growth of telephone communication has resulted in a vast network of telephone lines and installations throughout the country which can quickly be arranged to take care of the new defense requirements of the nation. It is also fortunate that the flexibility of the telephone system is such that a wide range of new services needed for the defense agencies can be developed and placed in operation in short order.

The Far Horizon

ALL OF THESE FACTORS—a trend to lower relative costs; the development of additional materials, devices, and facilities; and the development of needs of the telephone-using public—combine to stimulate the continued rapid growth of the telephone system. However, they would not of themselves have automatically resulted in the great growth and development which has taken place. This is also due in some part to the form of organization of the Bell Telephone group of companies.

In the Bell Telephone group are gathered together, in a closely cooperating group of companies, all of the necessary functions for giving telephone service, from the inception of an idea or birth of a need, through the stages of research, invention, development, trial, manufacture, construction, maintenance, and operation, to the rendering of the service itself. This wise form of organization gives maximum effectiveness to the initiative and resourcefulness of management and staff in expanding, developing, and strengthening the telephone service. It is a large factor in the high level of development of telephone service in this country.

Inscription on the Archives Building

IT WOULD BE natural, as a result of this discussion, to ask what will be the ultimate in telephone communication. In endeavoring to look forward, it sometimes stimulates the imagination first to look back.

When my father was a baby, the most important communication system in this country consisted of a pole bearing wooden semaphore arms, located on Signal Hill on Staten Island. As ships approached New York Harbor, that approach was communicated to observers at the Merchants Exchange by the mo-

tion of the arms. The change from that system to the present situation has taken place in a little more than 100 years.

With that background, let us say that in the ultimate, whenever a baby is born anywhere in the world, he is given at birth a number which will be his telephone number for life. As soon as he can talk, he is given a watch-like device with ten little buttons on one side and a screen on the other. Thus equipped, at any time when he wishes to talk with anyone in the world, he will pull out the device and punch on the keys the number of his friend. Then, turning the device over, he will hear the voice of his friend and see his face on the screen, in color and in three dimensions. If he does not see him and hear him, he will know that the friend is dead.

Some readers may feel that this is looking ahead too far to see clearly. For the sake of such, I should like to close with a prediction which is in no sense modest, but is nevertheless very clear to see.

By the steps of the Archives Building in Washington, where are stored the treasured records of the past, is inscribed the motto, "What is Past is Prologue." A friend of mine, driving through Washington in a taxicab the other day, asked the driver, "What does that motto mean?" "Well, mister," the driver replied, "roughly speaking, it means 'You ain't seen nothing yet.' "

Without attempting to predict how closely or how rapidly we may approach the ultimate ideal which I have just described, or any of the specific steps which we have been discussing, I predict with full confidence: "Gentle Reader, you ain't seen nothing yet."

From Collier's

"The trouble is, all the important discoveries have already been made"

More Than 470 Years of Bell System Experience

Name	*Present Position*	*First Bell Employer*	*Year*	*First Position*
Cleo F. Craig	President, A. T. & T. Co.	Long Lines Department, A. T. & T. Co.	1913	Equipment Man
Hal S. Dumas	Executive Vice President, A. T. & T. Co.	Southern Bell Telephone & Telegraph Co.	1911	Trouble Man
George L. Best	Vice President, Business Relations, A. T. & T. Co.	New York Telephone Co.	1922	Assistant Engineer
Carroll O. Bickelhaupt	Vice President and Secretary, A. T. & T. Co.	A. T. & T. Co.	1911	Junior Engineer
William C. Bolenius	Vice President, Finance, A. T. & T. Co.	New York Telephone Co.	1921	Traffic Inspector
Stanley Bracken	President, Western Electric Co.	Western Electric Co.	1912	Student Engineer
Fred R. Kappel	Vice President, Operation and Engineering, A. T. & T. Co.	Northwestern Bell Telephone Co.	1924	Groundman
Mervin J. Kelly	President, Bell Telephone Laboratories, Inc.	Western Electric Co.	1918	Research Physicist
Henry T. Killingsworth	Vice President, A. T. & T. Co., in charge of Long Lines Department	Long Lines Department, A. T. & T. Co.	1919	Draftsman
Prescott C. Mabon	Assistant to President, A. T. & T. Co.	Southern New England Telephone Co.	1934	Copywriter
Bartlett T. Miller	Vice President, Public Relations, A. T. & T. Co.	Colorado Telephone Co.	1910	Traffic Student
Clifton W. Phalen	Vice President, Personnel Relations, A. T. & T. Co.	New York Telephone Co.	1928	Lineman
T. Brooke Price	Vice President and General Counsel, A. T. & T. Co.	A. T. & T. Co.	1934	Attorney
Charles E. Wampler	Vice President, Revenues, A. T. & T. Co.	Illinois Bell Telephone Co.	1929	Student Engineer
E. Hornsby Wasson	Vice President, A. T. & T. Co.	Southern Bell Telephone and Telegraph Co.	1926	Service Salesman

Members of American Telephone Top Management Lead Organizations Which Help Bell Operating Companies to Render the Best Possible Telephone Service

Coördinated Leadership toward A Common Objective

Judson S. Bradley

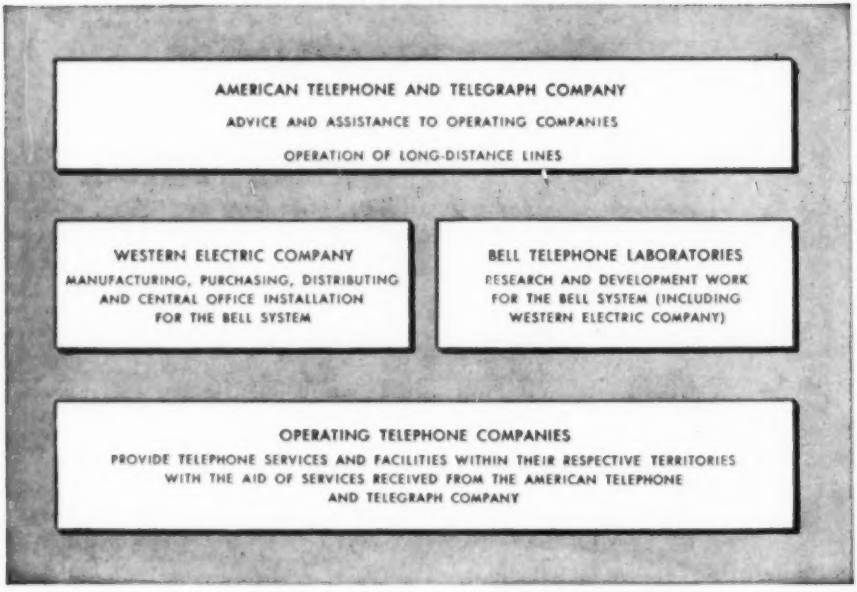
TEN O'CLOCK 'most any Monday morning finds fifteen men seated around a table in a room on the 26th floor at 195 Broadway in New York. They are the President of the American Telephone and Telegraph Company; its eleven Vice Presidents; the Assistant to President; and the Presidents of its research and manufacturing associates, Bell Telephone Laboratories and Western Electric Co.

What happens at these Monday morning meetings here is basically no different from what happens all over the territories of the System's operating companies. And like other telephone meetings, this week-to-week gathering has an important role in helping each participant to carry on his job. For all take part freely; and as each reports developments in his particular field of responsibility, all the others are brought up to date.

But there is more than information to be had at Monday's meetings. There is help when asked for: suggestions, advice, counsel, a pooling of judgment. When one of the group lays a problem before the others, it goes through the natural procedure of discussion and agreement.

And general agreement there needs to be, for the answer to one question almost never affects just one department. It is more likely to affect several or all of them. For the most part, the questions discussed are of a broad and rather basic nature; solutions to the others have already been found, so the decisions arrived at through discussion in these meetings will usually have wide influence.

Such meetings take but part of one morning a week. Consulting one another, discussing matters of common concern, seeking a fresh viewpoint—these things go on all the time. Most of the executive offices are on one floor at 195 Broadway, and it takes next to no time to drop in on a colleague in an adjoining room or across the hall.


AMERICAN TELEPHONE AND TELEGRAPH COMPANY
ADVICE AND ASSISTANCE TO OPERATING COMPANIES
OPERATION OF LONG-DISTANCE LINES
WESTERN ELECTRIC COMPANY
MANUFACTURING, PURCHASING, DISTRIBUTING AND CENTRAL OFFICE INSTALLATION FOR THE BELL SYSTEM
BELL TELEPHONE LABORATORIES
RESEARCH AND DEVELOPMENT WORK FOR THE BELL SYSTEM (INCLUDING WESTERN ELECTRIC COMPANY)
OPERATING TELEPHONE COMPANIES
PROVIDE TELEPHONE SERVICES AND FACILITIES WITHIN THEIR RESPECTIVE TERRITORIES WITH THE AID OF SERVICES RECEIVED FROM THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY

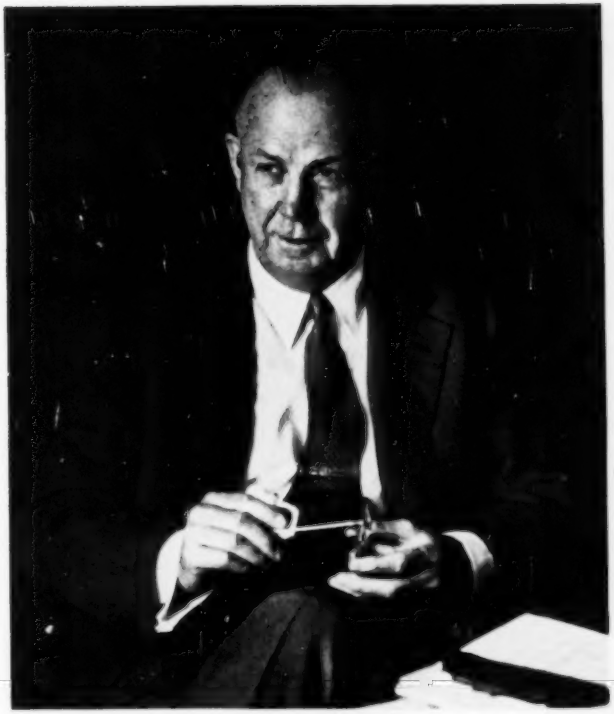
Principal Elements of the Bell System

All this adds up to a joint effort toward a common objective. What everybody is trying to do is help to render the best possible telephone service, and the particular responsibilities of A. T. & T. executives are carried out in close coöperation with their associates in all the Bell System Companies across the country.

The First Responsibility Is Local

Broadly, it works this way. The Bell System is organized on the basis that responsibility and authority for providing telephone service should function at the community level. For necessary coördination, the local operating organizations head up in 17 regional operating organizations, each with its own Board of Directors, president, and other officers, and each with the responsibility for rendering telephone service in its territory. At the same time, the regional organizations have many problems in common, so it is efficient and economical to have central groups working to help meet these problems for the benefit of all. Most of the members of the Monday morning meetings described earlier head groups of this kind. Another heads the Long Lines Department, which maintains and operates long distance telephone facilities interconnecting the territories of the regional Companies. And the Presidents of the Western Electric Company and Bell Telephone Laboratories are in charge of organizations which likewise serve the common interests of all the Companies—in the

(*Continued on page 85*)



CLEO F. CRAIG

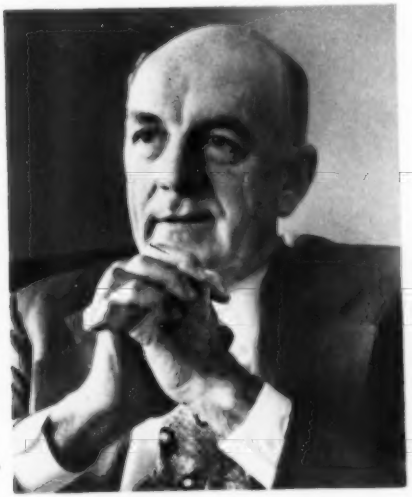
President, A. T. & T. Co.

Since July of 1951, Mr. Craig has been President of the American Telephone and Telegraph Company. His Bell System career, beginning in 1913, illustrates how broad may be a man's experience within the corporate confines of one or two companies. For his assignments in the Long Lines Department took him from St. Louis to Kansas City and Atlanta en route to New York, and to such diverse posts as district plant chief, plant accountant, and construction supervisor, among others—with a six-year interval as a special representative in the A. T. & T. General Department—before he became General Manager of Long Lines in 1933. He was elected Vice President in charge of the Long Lines Department in 1940, and the following year moved to A. T. & T. headquarters. There his vice-presidental responsibilities included, in turn, charge of the Departments concerned with Personnel Relations, Operation and Engineering, and Finance and Revenue Requirements.

HAL S. DUMAS

Executive Vice President, A. T. & T. Co.

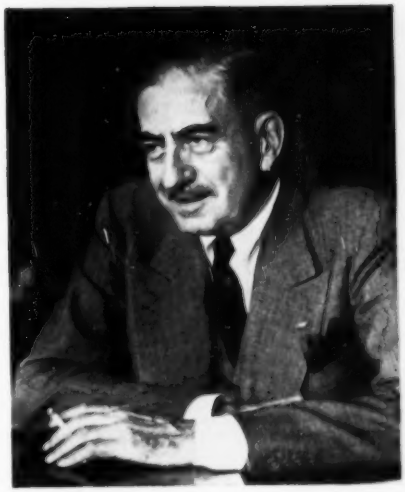
For forty years Hal S. Dumas devoted his life to the Southern Bell Telephone and Telegraph Company, eight of those years as President. Then, in July of 1951, he was elected Executive Vice President of A. T. & T. He started in Atlanta as a trouble man, moved to greater and greater responsibilities through the Traffic, Plant, and Executive Departments, and reached the top in 1943. Now the scene is different —and the duties too. As Executive Vice President, he assists the President in the general administration of the business, and acts for him in his absence. System executives who seek his counsel find it flavored with ripe judgment.



GEORGE L. BEST

Vice President, Business Relations, A. T. & T. Co.

Finger-on-the-Pulse-of-Business Department might also be descriptive of Mr. Best's major responsibility, since business research and the study of new business undertakings are specifically within his charge. So are such matters as new types of telephone service, and relations with other communications services. Mr. Best joined the New York Telephone Company 30 years ago, and devoted himself to rates and other commercial matters until he transferred to A. T. & T. fifteen years later. There he was successively rate engineer, commercial engineer, and assistant vice president. He was elected Vice President of Western Electric Company in 1946, with charge of the Patent Licensing Division, and in 1948 was given responsibility for Finance. In January 1950 he rejoined A. T. & T. and assumed his present post.



CARROLL O. BICKELHAUPT

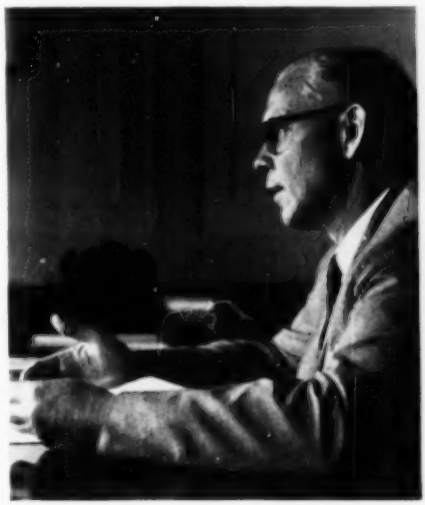
Vice President and Secretary,
A. T. & T. Co.

Mr. Bickelhaupt has had two distinguished careers: one in the telephone business—beginning with an independent telephone company—and one in the Army. With the A. T. & T. Company from 1911 to 1924, he was commercial engineer in the O. and E. Department when he was elected Operating Vice President of the Southern Bell Telephone and Telegraph Company as of January 1, 1925. After more than five years in Atlanta, he returned to New York. He was elected Vice President of A. T. & T. in 1941, and Secretary too in 1945. He was commissioned 1st Lieutenant, Signal Reserve Corps, U.S.A., in 1916 and saw service and promotions in two wars. During World War II he served as a Brigadier General overseas in a number of important communications assignments with the U. S. Forces in Europe and finally with the U. S. Military Government in Germany. He was retired from the Army Reserve in 1949.

WILLIAM C. BOLENIUS

Vice President, Finance,
A. T. & T. Co.

Twenty-two years with the New York Telephone Company, beginning in 1921, took William C. Bolenius from New York to various Upstate points, and he then became Vice President and General Manager of the Upstate Area. In 1946 he was elected Vice President and General Manager of the Wisconsin Telephone Company, and later the same year was made its President. He relinquished that post in 1948 to join A. T. & T. as Vice President in charge of Personnel Relations, and in July 1951 was appointed Vice President in charge of Finance. His responsibilities include assisting the Operating Companies with and coördinating their several financial requirements and directing both A. T. & T.'s Treasury and Comptroller's Departments.



STANLEY BRACKEN

President, Western Electric Company

Stanley Bracken's fortieth service anniversary was a recent event. His entire career has been spent with the Western Electric Company, of which he has been President since 1947, and it is another illustration of how broad such experience may be. For he began as a student engineer at the Hawthorne Works in Chicago, and his steady progress brought him such assignments as three years in Japan as consultant for Sumito Electric Wire and Cable Works, and the presidency of Teletype Corporation. His election as Executive Vice President of "W. E." preceded by only a few months his election to his present office. He heads a corporation having more than 90,000 employees and plants in a dozen cities. Its greatly expanded activities now include production of much important material for the Armed Forces.

FRED R. KAPPEL

Vice President, Operation and Engineering, A. T. & T. Co.

"From the ground up" accurately describes Fred R. Kappel's course in the Bell System. He started as a groundman with the Northwestern Bell Telephone Company in 1924, and held a dozen positions in the Plant, Engineering, and Commercial Departments in several States before he reached Company headquarters in Omaha. There he became in turn plant operations supervisor, assistant vice president—operations, and, for half a dozen years through 1948, Vice President in Charge of Operations. He went to New York in 1949 as assistant vice president in A. T. & T.'s Department of Operation and Engineering, and in that same year became successively Vice President in charge of Long Lines and Vice President in charge of the O. & E. Department. Comprising the Plant, Traffic, Commercial, and Engineering Divisions, the O. & E. is the A. T. and T. Company's largest department.

Mervin J. Kelly

President, Bell Telephone Laboratories

The concept of "the most service and the best" includes the provision of steadily improving equipment which contributes to economical as well as pleasing telephone service. That, in essence, is the objective to which the whole Bell Laboratories organization is devoted. Mervin J. Kelly, its head, joined the research division of the Engineering Department of Western Electric—predecessor of Bell Laboratories—in 1918. His assignments as director of vacuum tube development and as development director of transmission instruments and electronics preceded his appointment in 1936 as director of research. He became executive vice president in 1944, and, in the Spring of 1951, President of the Laboratories. When he joins the Monday morning group, he brings reports from the country's largest industrial laboratory.

Henry T. Killingsworth

Vice President, in charge Long Lines

From Denver on the West to Atlanta and New York on the East takes in a broad expanse of territory, and Henry T. Killingsworth became familiar with a good deal of it in the course of his Long Lines Engineering and Plant assignments in the three decades between 1919 and 1949. Through it runs a path which has been followed successfully by others in the executive group, and by 1949 it had led Mr. Killingsworth to an A. T. & T. vice presidency and responsibility for the Long Lines Department. This is an operating job, and, except in the matter of financing, is like running an Operating Company. He is doubly close to the members of the Monday morning group, for all A. T. & T. vice presidents serve on the Long Lines Board.

PRESCOTT C. MABON

Assistant to President, A. T. & T. Co.

As Assistant to President, Mr. Mabon helps Mr. Craig in many ways. He assists with reports and statements, with visitors and correspondence, with information required for various meetings and with information for stockholders—and with other related matters. Mr. Mabon serves also as an assistant secretary. He joined the General Information Department of The Southern New England Telephone Company in 1934, after several years of outside employment, and became general information supervisor there the following year. He joined A. T. & T.'s Public Relations Department in 1939, was appointed information manager in 1940, and became an assistant vice president in the same department in 1944. He has been Assistant to President since early 1949.

BARTLETT T. MILLER

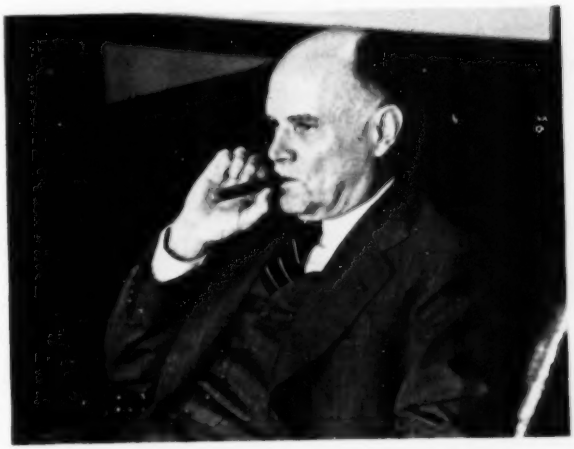
Vice President, Public Relations, A. T. & T. Co.

Service in what is now the Mountain States Telephone and Telegraph Company between 1910 and 1923 preceded Bartlett T. Miller's move to the New England Telephone and Telegraph Company and service in various New England cities. After becoming general traffic supervisor in Boston, he was appointed Commercial Department division manager for Rhode Island, and then general commercial manager at the Company's headquarters. He was elected Vice President in charge of Public Relations in 1944, and in 1945 he became Vice President and General Manager of the New England Company. He moved to New York in 1946, where he became an assistant vice president in the O. & E. Department. The next year he was elected Vice President in charge of Long Lines. He returned to the headquarters organization in 1949, and since 1950 has been Vice President in charge of the Public Relations Department.

CLIFTON W. PHALEN

Vice President, Personnel Relations, A. T. & T. Co.

Experience as lineman, installer, splicer's helper, and in other plant crafts with the New York Telephone Company, beginning in 1928, prepared Mr. Phalen for such responsibilities as district plant superintendent at Kingston and division construction superintendent and division plant superintendent at Albany. By 1943 he had been appointed an assistant vice president in Personnel Relations, and in the two succeeding years he became in turn Vice President of that Department and Vice President in charge of Public Relations. In 1948 he was elected to similar office in the A. T. & T. Company, which he held for two years. In 1950 he became Vice President, Rates and Revenues; and since July 1951 he has been Vice President, Personnel Relations.



T. BROOKE PRICE

Vice President and General Counsel, A. T. & T. Co.

Corporate law is a highly specialized field, and requires a kind of training and experience which cannot be acquired in the telephone business. Mr. Price entered Bell System employment in 1934, and in 1936 became Vice President and General Counsel of the Western Electric Company. But he had been practicing law since 1915, and had been for many years a member of a legal firm which A. T. & T. had consulted upon occasion for ten years preceding his election. He moved from Western Electric to become A. T. & T. General Attorney in 1941, and ten years later was made Vice President and General Counsel.

Charles E. Wampler

Vice President, Revenues, A. T. & T. Co.

Mr. Wampler's telephone career began with the Illinois Bell Company in 1929, and he became an assistant vice president in Chicago in 1948. Sandwiched into the intervening years were graduate study at M.I.T., service in Washington with WPB, and four years in the Army—which brought him duty in France and Japan. In 1949 he joined A. T. & T., and became successively an assistant vice president in A. T. & T.'s Personnel Relations Department, General Manager of the Long Lines Department, and an assistant vice president in the O. & E. Department. Early in 1951 he served with the Defense Production Board in Washington, from which he returned to become an A. T. & T. Vice President in charge of revenue requirements and studies.

E. Hornsby Wasson

Vice President, A. T. & T. Co.

Hornsby Wasson's first regular telephone job was as a salesman of long distance telephone service for the Southern Bell Telephone and Telegraph Company in Chattanooga, Tenn., in 1926. By 1933 he had been appointed division sales manager for that State. After other responsibilities in Mississippi, Louisiana, and the Carolinas, he was made General Commercial Manager of the Company in 1947. Three years later he was elected Vice President of the Northwestern Bell Telephone Company, in charge of Public Relations. At the end of 1950 he became Vice President and General Manager of the Company's Minnesota area—the position he left on July 1, 1952, to accept an A. T. & T. Vice Presidency. His present responsibilities include advice and assistance to Bell System Companies on regulatory matters under the jurisdiction of the Federal Communications Commission, as well as matters involving the National Association of Railroad and Utility Commissioners.

(*Continued from page 76*)

one case by providing standard equipment of high quality at reasonable prices, and in the other by carrying on continuous research to develop better equipment and systems for doing a better telephone job at the lowest possible cost.

The Men Themselves

THE INDIVIDUALS who attend the "Monday morning meetings" range in age from 44 to 63. Four are in their early sixties, seven in their fifties, and four in their forties.

More significant are the years of experience in the telephone business. Collectively, this group of 15 have had more than 470 years of experience in just about every phase of the work, from digging pole holes and collecting bills on up. Four men have had more than forty years of service apiece. The shortest period of service is mere than 18 years, and the average is more than 31 years of Bell System service.

The men come from a dozen states. Four were born in the East, five in the Southeast, and six in the Mid-West. Most are from small towns.

All are married. Most have children. Six are grandparents, and the total number of grandchildren is 30.

Not all members of the group went to college. But in a business whose basic operating medium is electricity, it is not surprising that three-fifths of them have the Bachelor of Science degree. Several others have B.A. diplomas. Advanced study on the part of a few has brought the total of degrees earned up to a score, and there is a scattering of honorary degrees. The scenes of their education range alphabetically from Alabama Polytechnic Institute and Amherst to Wisconsin and Yale.

Starting at the bottom brings beginner's pay. The five members of the group who joined the Bell System before World War I earned in their first year a total sum of $3400, or an average of $680. The low was $520—$10 a week—and high was $780. The starting years range from 1910 to 1934. The average starting salary (omitting Mr. T. Brooke Price, Vice President and General Counsel, who joined the Bell System after practicing law for more than 20 years) figures out to something less than $24 per week.

There in brief you have the men who gather around the table in A. T. & T. Monday morning meetings.

Emphasis has been placed on their long experience in the telephone business, and their competitive rise from the ranks. In this business there is no substitute. But there is another side to their interests. All have accepted, and most still carry, civic and social responsibilities. Hospital boards, church groups, community chests, school committees—the list is long. Telephone people try to be good citizens and carry their share of the load.

Communication Is Two-Way

AS WORKING PRACTICE, the members of our group and the members of their respective organizations are in close and frequent contact with their associates in all the Bell System Operating Companies. Also, conferences are held from year to year and sometimes more often. The

presidents of all the Companies will meet with the A. T. & T. executive group; the operating vice presidents with the A. T. & T. Vice President for Operation and Engineering and his principal division heads; the public relations officers of the Companies with the A. T. & T. Public Relations Vice President and his group; financial officers with the Financial Vice President and his group; and so on. Communication is always two-way. Ideas and suggestions flow in both directions, and this is true in the day-to-day contacts as well as in scheduled meetings. It is in this way, through give-and-take discussion, that the Companies develop their programs for action, and in this way too there are developed those basic guiding concepts which, taken together, constitute "policy."

The A. T. & T. executive group perform their functions in liaison with the Presidents of all the System Operating Companies. Incidentally, it is interesting to note that not long since, two former members of the A. T. & T. group were elected as Presidents of Operating Companies, and two who had previously served as Company Presidents accepted new posts with A. T. & T. Changes of this kind point to an important fact about Bell System leadership: that the reservoir of leadership is the entire organization, from which able executives are continually emerging.

Aiding this process are the measurements and the comparisons of the results of performance in all phases of the business made by all Bell System Companies—exchange by exchange, district by district, area by area, company by company. This helps to bring forward able men in the Operating Companies, and their opportunities are broadened as they develop the qualities needed to accept greater responsibilities. That is how the Bell System's present leaders have been developed. That is how tomorrow's leaders will be found.

United in a Common Purpose

IT remains only to add that these fifteen men would be the first to tell you —and mean it—that they simply endeavor to do some forward thinking and to coördinate; that they rely on the abilities and effective teamwork of all the people in the groups they head; that it is the Operating Companies which are responsible for and furnish telephone service to the nation; and that the success of the whole nation-wide telephone system and service grows out of the spirit and skill of more than 650,000 men and women who unite in a common purpose in performing their important individual tasks.

Special Group Is Busy Writing and Revising "Bell System Practices," Operating Handbooks of which the Associated Companies Acquired a Million Copies Last Year

The Bell System's Best Sellers

A. B. Covey

THERE IS a small office building in lower New York City whose entrance is so inconspicuous that a chance observer might pass by without even noticing it. Should he enter the building, however, and proceed to the third and fourth floors, he would find himself in a beehive of telephone activity. For the two floors house a group of men from the Engineering and Plant Departments of the Bell System's Associated Companies who have accepted temporary assignment with the Operation and Engineering Department of the A. T. and T. Company. These men are engaged in the preparation and revision of urgently needed Bell System PRACTICES.

Bell System PRACTICES are the instructions which describe the best methods of engineering, installing, constructing, and maintaining the telephone plant. The engineers use the PRACTICES as guides in the design of cables, open wire lines, radio systems, carrier systems, and the many types of central office equipment. The installers use them as instructions for installing telephones, private branch exchanges, and Teletypewriter equipment. The construction forces use them in the construction of cables and open wire lines. The maintenance forces use them in the maintenance of all forms of central office and private branch exchange equipment, subscribers' station equipment, cables, and open wire lines. PRACTICES are also used for training purposes both on the job and in training schools. They are used not only in every Operating Company but also in the Western Electric Company and the Bell Telephone Laboratories.

During 1951 these Companies acquired over one million copies of the PRACTICES.

Bell System PRACTICES are, obviously, an integral part of telephone

operations. They are as important working tools as any the operating forces use. Thus, they play an important part in providing the public with the best and the most telephone service at the lowest possible cost.

The preparation of such information * has been one of the major functions of the Bell System headquarters organization for almost three-quarters of a century. During that time, these instructions have grown from a few circular letters to a library of over 9,000 separate pamphlets or sections. Many times it has been necessary to call on the Operating Companies for assistance in their preparation, and now the situation has arisen again. The Companies have responded with the largest group of PRACTICE writers in history, organized since the middle of last year in the separate establishment already referred to.

In preparing PRACTICES, those writers are following a plan established over 20 years ago. Let's take a look at some of the developments which resulted in the creation of the Bell System PRACTICES Plan, the events leading up to the organization of the present special writing group, and also a brief look at a typicial writer's job.

* While the discussion here is limited to Bell System PRACTICES, information of many other types is issued by the General Departments of the A. T. & T. Company as part of the constant process of furnishing advice and assistance to the Operating Companies.

The book-case contains about a third of the present active sections of Bell System Practices. They are kept in binders for convenient use

Early Forms of "Practices"

IN 1879, The National Bell Telephone Company was already established, with headquarters at 95 Milk Street in Boston. W. H. Forbes was president, Alexander Graham Bell was electrician, Theodore N. Vail, general manager, and Thomas A. Watson, general superintendent.

There were approximately 16,000 telephones in the country at that period, and Mr. Watson was spending most of his time trying to make them work. The subscribers of that day were not very critical of the failures of the telephone apparatus; they were amazed that it worked at all. But the difficulties experienced by the licensees, or agents, as they were called, resulted in a continual stream of questions to the National Bell in Boston on the design and maintenance of the telephone apparatus.

Answers to such questions were provided by means of circular letters, and a number of these are still preserved. It is interesting to note the

general similarity between those early letters and the drawings, descriptions, and data incorporated in the present-day Bell System PRACTICES.

Many years later, Mr. Watson was consulted on the historical facts about the information furnished the "Operating Companies" in those early days of the telephone. The need for this kind of information could best be explained, he responded, by a trip he made through the West in 1878 to inspect the telephones that were then in use.

A group of "Practice" writers at work in their special quarters

"My route took in Chicago, Milwaukee, Pittsburgh, Washington, and all of the larger cities on route," he said. "I found our telephones giving fairly good satisfaction to the users, although to me, when I tested them, they seemed to work badly. I was especially dissatisfied with my call bells. Both telephones and bells had evidently been neglected since they had been put into use; apparently nothing had been done to them in the way of cleaning or adjustment since they left the shop. My time on this trip was largely spent in showing our men how to adjust the instruments and impressing them with the need of constant inspection to keep them working at their best." Thus, from the start there was a real need to get into the field people's hands the necessary information on the proper maintenance of the equipment.

While not a matter of record, stories handed down from the "good old days" make it appear that standard procedures were not always followed. One tale relates to an operator who undertook to clean the switchboard plugs with steel wool. It seemed like a good idea—especially as the plugs were thoroughly cleaned. The "out" was that fine steel slivers adhered to the plugs, so that when they were inserted in the switchboard jacks they "shorted out" the jack contacts. The plug cleaning was necessarily followed by a thorough job of jack cleaning.

Another "off the record" yarn tells of an equipment attendant who was having trouble with a bay of equipment which contained a good many relays. Each morning, when he came to work, he found an accumulation of trouble reports which past experience told him were caused by "sticky" relays in the bay. Finally, he resolved to take drastic action; and each morning thereafter he hit the bay a wallop with a short length of two-by-four. The method was temporarily effective, but ultimately it was recognized as not a standard method of clearing the trouble.

Such incidents, however apocryphal they may be, do emphasize the

An early "Practice," covering the No. 7 subscriber's set

place of PRACTICES in Bell System operations.

Two important PRACTICE developments stand out in the period up to the end of World War I.

1. *The inauguration of standard drawings as a means of furnishing information to the Operating Companies on new circuits and equipment. This method is still in use.*
2. *The introduction of the numbered specifications, covering principally outside plant construction items such as cables and open wire lines.*

Copies of some of the early drawings, dating back to the 1880s, are still preserved on microfilm at the Bell Telephone Laboratories.

The numbered specifications made possible the construction of the early open wire and cable lines. Viewed in the light of present-day standards, the methods were crude, but they filled the needs well, as is evidenced by the long periods of satisfactory service the lines rendered.

Developments after World War I

IN THE DECADE following World War I, there were more developments in the PRACTICE situation than in any other similar period in Bell System history. In practically all of these, the Operating Companies played an important part. The developments were a direct result of concerted efforts to provide information in pamphlet form for use in the field. Those of particular interest were:

1. *Numbered Bulletins*
2. *Transmission Maintenance Practices*
3. *Handbooks of Outside Plant Engineering Practices*
4. *Transmission Practices*
5. *Bell System Maintenance Practices*
6. *Building Practices*

By 1930, PRACTICES were being issued to the Operating Companies

covering a major part of the operations carried on by the Plant and Engineering Departments. The transmission people had their method of distribution, the outside plant another method, the maintenance people still another. There was a real and obvious need for a coördinated plan of distribution. Again the Bell System team went into action: a new Bell System PRACTICES Plan was evolved. This provided for the inclusion, in one comprehensive scheme, of all instructions used by the Plant and Engineering people.

The Beginning of "Bell System Practices"

THE PLAN involved the establishment of a number of series of PRACTICES, each carrying the common title BELL SYSTEM PRACTICES. In addition, a supplementary title was assigned to each series to describe the particular type of plant and character of work involved. These titles are listed in the adjoining column.

To simplify distribution of the PRACTICES, a method was devised whereby the Western Electric Company made bulk shipments to the Operating Companies in accordance with established routines, while at the same time A. T. & T. forwarded advance copies to Company Headquarters. This general scheme is still in effect today.

The addition of PRACTICES on *plant assignment, Teletypewriter, foreign wire relations, equipment engineering, transmission engineering,* and *radio systems* followed during the next few years. The *buildings and grounds maintenance* series was changed and enlarged. By 1940, the

BELL SYSTEM PRACTICES

1. *Central office maintenance,* covering methods and procedures for maintaining central office equipment.

2. *Private branch exchange installation and maintenance.*

3. *Station installation and maintenance,* which covered both telephone and telegraph stations.

4. *Toll test room operation,* describing the operation of toll test boards and the service maintenance of all types of toll telephone and telegraph circuits and systems.

5. *Transmission testing,* relating to transmission tests generally made by traveling testing crews.

6. *Recovery and repair,* describing methods of handling and reconditioning used apparatus, equipment, and material which has been removed from the plant.

7. *Exchange test room,* covering the work associated with the local test desk, the duties of the repair service clerk, and associated routines.

8. *Building and grounds maintenance.*

9. *Motor vehicle maintenance,* covering the care of both motor vehicles and garages.

10. *Outside plant construction and maintenance,* covering both aerial and underground outside plant.

11. *Outside plant engineering,* dealing with the structural design of pole lines, cables, and underground conduit.

(*Supplies,* planned but finally omitted.)

An example of terminal pole construction in the 1890s

Bell System PRACTICES Plan was in full swing, with instructions being issued on practically every operation carried on in the Plant and Engineering Departments.

The PRACTICE activity was much reduced during World War II and in the early post-war period because of the demands on manpower occasioned by the war effort.

Present "Practice" Activity

THE year 1949 saw Bell System PRACTICES little changed from their original form of 1930. There were many indications that they had contributed largely to improved engineering, construction, and maintenance procedures and to reduced costs. A good many more, however, were urgently needed. This was brought about by two factors:

Shortage of manpower for this work during and immediately following World War II.

Large number of important developments in the period prior to and following World War II.

System operations had undergone many changes in the years since 1930. The changes, plus the need for other instructions, raised the question as to whether the current arrangements of Bell System PRACTICES were meeting the requirements of the Operating Companies in the best possible way. To find the answer to this question, a Joint Committee, consisting of representatives of the Bell Telephone Laboratories and the Operating and Engineering Department of the A. T. and T. Company, was formed early in 1950 to review the entire matter of the preparation and distribution of Bell System PRACTICES.

The Joint Committee established a full time "working group" to assemble the facts about the situation. The group consisted of two men from the A. T. & T. Co., one man from the Bell Telephone Laboratories, and eight men borrowed from the Operating Companies. Each of the field men was selected from a different Company: four from the Plant Departments and four from the Engineering Departments. One of the important requirements was that each man should have several years' experience in some phase of System operations which is covered by one or more of the various series of PRACTICES.

The "working group" circulated a questionnaire designed to bring out the present uses and the extent of distribution of Bell System PRACTICES in each of the Operating Companies. Members of the group also made

RECOMMENDATIONS OF THE JOINT COMMITTEE

1. *Organization of the* PRACTICE-*writing work*, to bring the PRACTICES reasonably up to date and to keep pace with the developmental effort.

2. *Reduction in the number of series*, to increase effectiveness, avoid duplication, and reduce preparation effort.

3. *Changes in the style of presentation*, to make increased use of charts and other condensed and simplified methods of covering the necessary information.

4. *Inclusion in practice form initially* of much of the material now covered in general letters.

5. *Changes* in organization, numbering plan, and indexing of the PRACTICES.

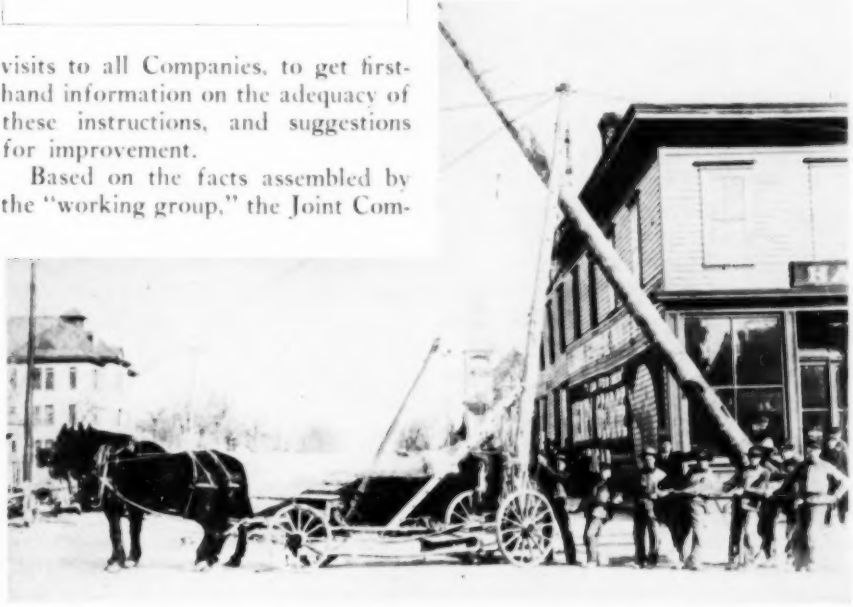
visits to all Companies, to get first-hand information on the adequacy of these instructions, and suggestions for improvement.

Based on the facts assembled by the "working group," the Joint Committee recommended certain steps as a means of making the PRACTICES more useful to the Companies. These are given in the adjacent box.

Organization of "Practice" Writing Groups

ACTIVE WORK to carry out the Joint Committee's recommendations began in the middle of 1951. The PRACTICE-writing activity at the Bell Telephone Laboratories was substantially increased. To expedite the work, 15 people from the Operating Companies and a considerable number of technical assistants were added to the development force.

A force of 65 men was borrowed from the Operating Companies to assist the Operation and Engineering Department of the A. T. & T. Co. to



An "improved method" of pole raising, for which there probably was no "Practice"

bring the PRACTICES up to date. The men were selected as specially qualified from the standpoint of field experience.

The present PRACTICE writers have had experience in almost every operation of the Plant and Engineering Departments. The average Bell System service of the group is over 22 years. Practically every one of the Operating Companies is represented. History repeats itself—two of the men who were on loan to the A. T. & T. Co. as practice writers about 20 years ago are back on loan again, serving in a supervisory capacity in the group.

"*Practice*" *Preparation: Hard Work, Perseverance, Patience*

THE WRITER'S JOB starts with the need for a PRACTICE: a new development, perhaps, an improvement or change in an existing circuit, or an unusual operating condition arising in one of the Companies.

Upon receipt of his assignment, the writer proceeds to gather his basic material for the particular PRACTICE. He consults drawings, old issues of PRACTICES, general letters, posted comments from the Operating Companies in the form of engineering complaints, letters, and locally issued practices; Bell Telephone Laboratories notes; members of the A. T. & T. Headquarters staff, the Bell Telephone Laboratories, and in some cases one or more of the Operating Companies. He may also go out on a field trial of a new development, to secure first hand information.

Once the information is available, preparation of the first draft begins. At this time the writer lays plans for any illustrations required. He may decide to use only pencil sketches in the early stages, or he may feel that it is advantageous to have the Drafting Department prepare the drawings in final form.

When the writer finishes the draft of his text, copies are sent out for comments to members of the A. T. & T. Headquarters staff, the Bell Telephone Laboratories, and, in some cases, a few of the Operating Companies.

Comments are generally received from most of the people to whom copies of the PRACTICE have been sent. If the comments are minor, the writer can proceed at once to incorporate them in his draft. If major comments are involved, he must hold up the revision pending the results of a conference among the persons concerned. In the revision process, the writer usually finds that a pair of scissors and a tube of rubber cement are important tools. Coincident with the incorporation of comments, any changes required in the illustrations are made.

In reviewing the comments, the writer sometimes finds that one comment may be diametrically opposite another in its apparent intent. He must reconcile these, keeping constantly in mind that when the PRACTICE is issued, it must represent the best views of the A. T. and T. Company, the Bell Telephone Laboratories, and the Operating Companies.

Accuracy also the writer must always have before him. He realizes that a transposition of digits in the code number of a piece part may mean the difference between a very

This is the group of writers borrowed from the Associated Companies—less four who were unable to be present

small motor and a large motor-generator set. A misplaced decimal point in a Transmission PRACTICE may result in the design of a circuit which is inoperative. The writer knows that with the wide distribution of this material, the impact of an error will be great.

After all comments have been incorporated and the copy retyped, the writer may feel that he is ready to submit the revised copy for approval. However, if some of the comments were major, he may decide to submit the copy for further check by the interested persons. In such cases, further revisions may be necessary.

Once approval is obtained, the remaining work of the writer is largely that of making sure that no errors creep in during the reproduction process.

As may be surmised, the writers have had to overcome many difficulties. But their efforts have resulted in an appreciable increase in the production of PRACTICES; a real dent has been made in the "urgent" backlog. Furthermore, many new ideas and improvements, in line with the Joint Committee recommendations, have been introduced. Already many of the instructions prepared by the present groups of writers are in use in the Operating Companies, and the comments concerning them demonstrate that the authors are equipped with the "know-how" of PRACTICE writing. The writers themselves are of the unanimous belief that the experience they have obtained will be of great help to them upon return to their home Companies.

The value of PRACTICES to the Bell System, and indirectly to telephone users, has been demonstrated time and again: in normal day-to-day operations and during emergencies. Bell System PRACTICES have played an important part in holding costs down and in helping to meet the System's objective of constant improvement in service. They are a direct result of the efforts of the entire Bell System team: design, manufacture, and operation.

On Being a Responsible Individual

Cleo F. Craig

On June 5, 1952, the honorary degree of Doctor of Laws was conferred on President Cleo F. Craig of A. T. & T. by his Alma Mater, the University of Missouri, from which he had been graduated in 1913 as a Bachelor of Science. The following paragraphs are from Mr. Craig's address to this year's graduating class. EDITOR

As you take your place in your respective communities, you and your neighbors can and must determine how much responsibility and freedom you want. In the event you don't feel very courageous or competent, you will let the government—which is made up of people much like you—decide what you shall do and when and how you shall do it.

After all, if your community gives up or fails in its functions, the state will surely move in, and your influence is smaller in the state than in your town. If the state fails, the Federal Government moves in and your influence is still smaller there.

In fact, a people who form the habit of taking orders from a central government are conditioning themselves for dictatorship. What then happens is that no one except the people at the center retains any organization or authority or has kept in practice for doing anything.

Today, our communities and our country have great need for a renewed and a stronger belief in freedom for the individual. Our nation is *us*—the people of America. For our nation to stay free, we as individuals must keep ourselves free. No other people can destroy our freedom. None can maintain that freedom—but ourselves. And working at preserving our freedom means, among other things, being enough concerned with government to see that it is run honestly and with as little control over our personal and family affairs as is really necessary.

Some of the most difficult and important opportunities that you as Americans have to deal with are in this field.

IN THE FIELD of business, likewise, there is fruitfulness in freedom. Almost any organization does better when it puts all the responsibility it can on the people down the line and gives them the greatest freedom possible. In a large business, where many people are involved, it is a high

art to hold to a common purpose—a common standard—and at the same time maintain freedom for those at all levels to use their brains and energies.

I could take your own future as an illustration.

If you start working in some organization and therefore under supervision, I forecast you will crave more freedom. You will complain to yourself and others of red tape, lack of imagination, and all the blunders that your bosses commit. And you will be at least partially right; for in spite of diligent efforts toward decentralization in recent years, management in general has a long way to go in this difficult direction. There is great opportunity here, and I hope that as you progress and occupy seats of authority, you will remember your own complaints and see if you can improve the lot of the youngsters who follow you.

AND MAY I make another comment? On the average, you will be fit for promotion before you get it. Fitness often has to be demonstrated in a number of ways and to more than one individual. That takes a little time.

Also, when you are ready and capable of moving up, there must be a place to move to—or you can't move. However, if you are really good promotable material, such periods when you seem to be standing still will be short, and you can help to shorten them even more by continuing to do the job at hand so well that you become the logical candidate for a move.

It isn't your standing or rank at any one moment that counts. It's what you do in your job. Will you give it your best and keep on giving in spite of everything?

If you will, the difficulties will only stimulate you—not discourage. You will grow strong from your troubles. You will create for yourself unlimited opportunity. And that is true in business, agriculture, education, or any of the professions or other pursuits for which you have been preparing yourselves. . . .

One further thought that I will just mention: The way responsibilities have to be divided these days, many of you will be doing rather specialized work. In producing more goods and new kinds of goods, the specialist has a very important part to play. He can play it best, however, if at the same time he keeps his angle of vision wide.

HOW USEFUL some of you may be in a particular line of work depends on whether you keep your ideas wider than your specialty—on how well you can see the meaning of what you are doing in relation to the work of others.

You remember it was said of St. Francis of Assisi that one day when he was hoeing in his garden, someone asked him what he would do if he knew he would die at the end of the day.

He answered that he would finish hoeing the garden.

The meaning of that to me is that he had a clear understanding of the relation between what he was doing and all the rest of life. His thought traveled farther than the handle of the hoe.

He also knew that the way he looked after his own little patch of

ground was important. And it's just as important to you as it was to him.

THE more highly organized our society becomes, the more our activities are joint with other men and women, the more we depend on each other. But we can only depend on each other if individually we set worth-while goals. No group of people can advance except as individuals in the group grow and develop.

How does a responsible individual grow? What is the kind of thinking that guides him? And how does he measure his growth?

I think first he tries to keep in mind that the real measure of all his effort is not what he gets in material things but rather what he becomes. It is what he becomes—and keeps on becoming—that determines his influence and effect on the lives of other people. And he realizes that only as he can influence others for good, will he truly accomplish anything.

The process he follows is pretty much a process of taking on larger responsibilities in exchange for smaller ones. And he makes his influence felt largely by example. By excellence of workmanship—how he cares for his own patch of ground. By willingness to do the hard jobs. By giving his fellow-men and women an extra something of value. Thus by his own actions he makes it easier for the neighbors to do likewise.

The world is so big, and so full of machinery, that you may think it somewhat overpowering.

But don't let size and machinery dismay you.

Everything worth while still begins with a human being—with a person just like you. The progress of a country comes not so much from mass action as from individual improvement.

THE WARS and the trials that have been shaking the world have cost us much here in America. They have left us with less liberty than before, and our opportunities are more difficult, perhaps, than they used to be. Regardless of where or how these matters begin, they are costly to everyone.

But there is no necessity for the loss to be permanent. The remedy —and I repeat—is within the individual: within you.

As to the outcome, I am strongly optimistic. . . .

You who are graduating have a great heritage.

I know you will cherish it and make your own important contributions to it—that you will build it even stronger.

And so I have complete faith that you and Americans like you will fortify your determination to remain free men and women; that there will be courage in full measure to defeat the threats we face. . . .

Memorial Day Ceremonies at A. T. & T. Headquarters Honor Bell System Men and Women In Two Wars

Ceremonies observing Memorial Day were held on May 29 before the commemorative plaque in the lobby of the American Telephone and Telegraph Company building at 195 Broadway in New York City. They were conducted by Bell Telephone Post 497 on behalf of all Telephone Posts of the American Legion, since the plaque commemorates the sacrifices of all Bell System employees who served in two wars.

President Cleo F. Craig of A. T. & T. and Mr. J. J. Morrow, Commander of the Legion Post, placed a wreath at the base of the bronze memorial tablet. This was followed by a moment's silence and the sounding of Taps.

Before the placing of the wreath, Mr. Craig spoke briefly of the significance of the gathering, which numbered some two thousand telephone people. They had come together, he said, "to pay tribute to our fellow men and women of the Bell System.

"The plaque which commemorates their service and sacrifice was erected to be a constant reminder of our pride in them and of our gratitude to them. It reads:

> *" 'In lasting memory of one thousand seven hundred and sixteen Bell System employees who gave their lives for their country in two world wars and in honor of all of the ninety-four thousand eight hundred and forty-seven who served.'*

"To these we now add, and remember in our thoughts and prayers, sixty-three who have given their lives since the conflict in Korea began and sixteen thousand eight hundred now with the colors.

"As citizens and as members of the Bell System, we are all in the service of the nation.

"May we draw courage from the memory of those we honor, and may our prayers for them renew our faith and strength to accomplish the tasks that are ours."

Last Remaining Sections of Veteran New York-Washington and New York-Chicago Circuits Will Follow Philadelphia-Chicago Line into Oblivion Before Long

Noted Old LD Lines Are Finally Retiring

Richmond B. Williams

Note: Something of the high adventure of America's pioneering days still persisted when the early long distance telephone lines were built, half a century and more ago. The news that the remaining sections of three of these old lines were about to vanish evoked in some of the men who worked on them recollections of those undertakings and of a period when the blacksmith and the twenty-five cent dinner were still honored members of the American community. The following article is based on the responses of some 70 telephone men to requests for first-hand information about this trio of yester-year's lines. R.B.W.

As TELEPHONE HISTORY lengthens, and new facilities, such as radio relay, come upon the communication scene, the veteran plant of yesterday gradually disappears. For some time, only short sections of the pioneer New York-Washington, New York-Chicago, and Philadelphia-Chicago open-wire lines have been in service. And recently even these spans have been dismantled or are scheduled to go ere long.

These old lines did more than expand the sphere of long distance telephony. As they made their difficult way across rocky fields, swamps, rivers, forests, and mountains, these lines provided all the classic problems to test the stamina and ingenuity of construction forces and those charged with maintaining that comparative unknown—a very long telephone circuit. They also were periodically rebuilt to some degree as new types of equipment—loading coils, for instance, and later repeaters—were developed for better transmission. Again, they carried some of the first private line services for financial houses and the press; and

The men and equipment under Foreman J. O. Murphy line up for a photographer (atop a building in the fair grounds at Ridgeway, Pa.) to show what the well-set-up construction gang looked like in 1896

much early carrier telephone and telegraph development work was performed over their spans of copper.

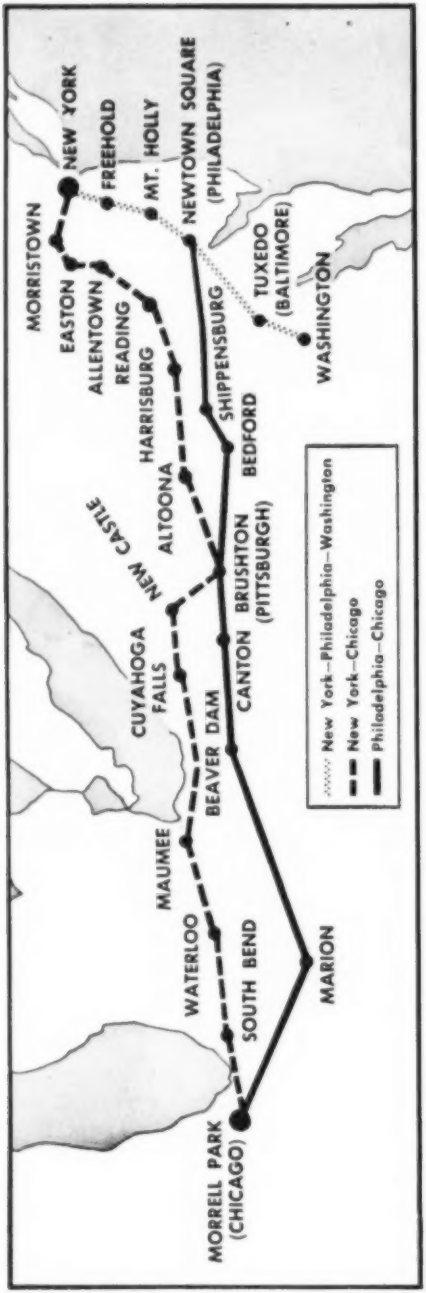
These vanishing lines touched a number of offices which in themselves have become centers of telephone history. What old timer, for example, hasn't recollections of Newtown Square and Brushton, Pa.; of Maumee, Ohio; and of Morrell Park, joined to Chicago by a "bob tail" street car?

Over the years many sections of these pioneer lines have been disposed of. However, such action by no means spells any waste of valuable materials. Sometimes, after finishing its long distance role, a section may merely change function and become part of local or regional telephone facilities. Or the re-usable poles, cross arms, and hardware may find their way back into telephone plant at other places. Significantly, in these critical times, copper wire and other metals will be re-smelted as usual for immediate re-use for vital communications purposes. Finally, a fragment may form a souvenir, cherished by a telephone man for its associations.

New York to Washington

THE New York-Washington line, a real A. T. & T. Company pioneer, started out as the New York-Philadelphia line, which was built between August 1885 and April 1886. Between April and November 1889, it was extended to the national capital, and its name was changed accordingly. To handle increased traffic, the original section between New York and Philadelphia was supplemented by a second line, built between July 1900 and May 1901.

The first section was made up of about an equal number of cedar and pine poles, originally 45 feet tall but



later shortened to a little over 30 feet. It carried 24 copper wires, and a so-called iron "zero" wire as well, affixed to the top of the poles. This addition, thought to add to the stability of the line, was later used as a grounded telegraph circuit. In those days, incidentally, the present system of referring to the size of wires by their diameter in mils was not followed. The records mention Nos. 12, 14, and 16 gauge. The first was the strongest. Later the even stronger No. 8 gauge was also employed.*

The second section—between Philadelphia and Washington—had about four cedar poles to every pine pole. Originally 40 feet tall, they too were cut down to the same height. At first only ten copper wires and the iron zero were stretched on this part of the line. The remaining span of the original New York-Washington line, still standing between Mount Holly and Camden, N. J., is due to be dismantled this Fall.

New York to Chicago

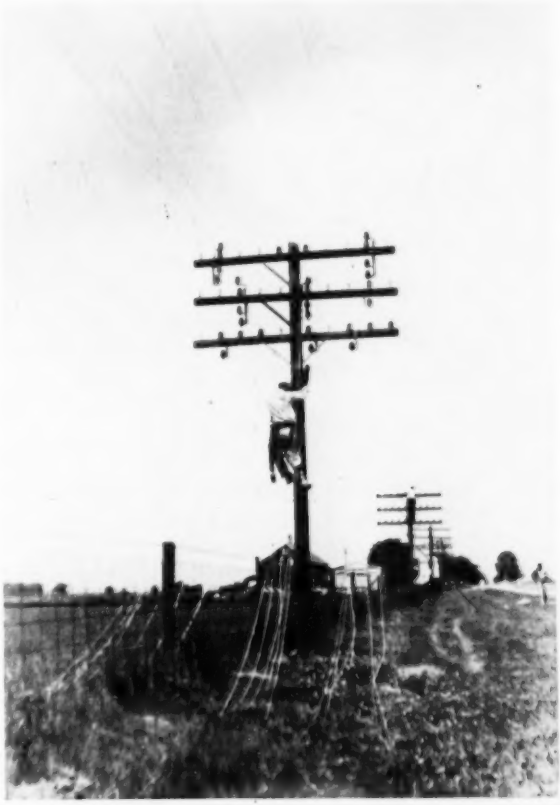
THE LINE between New York and Chicago was built in eight sections, to be ready for the famous World's Fair held in 1893 on the shores of

* This, a size in Birmingham Wire Gauge, was generally used for iron wire, but Long Lines used it for copper wire. Its diameter is .165 mils. No. 12 (New British Standard) is .104 mils. Cable conductors then as now were ordinarily coded according to the American Wire Gauge, which is identical with the Brown & Sharpe Gauge.

Left: One of these three historic old telephone lines is no more, and the other two are due to follow it into oblivion

Lake Michigan. The eastern portion, originally known as the Pennsylvania Central Line, was begun in November 1889 in Jersey City and was completed to Pittsburgh in October 1891. It was almost entirely composed of 35-foot cedar poles, later cut back to about 30 feet, and its various sections carried between six and ten copper wires as well as the iron zero wire.

The western portion, begun in February 1891, was finished in October 1892, when it reached a point one mile west of Hammond, Ind. Here it was connected with the A. T. & T. Company's Chicago-Blue Island line, which had been built between January and July in 1889, in anticipation of the construction of the line extending westward from New York.



Goodbye to an old timer: the last section of the original Philadelphia–Chicago line, from Marion to Logansport, Ind., was dismantled last October

Cedar poles varying in height between 40 and 45 feet were used on the western portion of the New York-Chicago line, but ultimately they too were leveled off at about 30 feet. This portion also carried between six and ten copper wires and the familiar iron zero. The remaining link of this pioneer line—between Maumee, O., and South Bend, Ind. —is slated for later dismantling.

Extension of telephone circuits was, no doubt, in line with the report by A. T. & T. President Howard Stockton, in March of 1888, that "The income from the long lines is now more than sufficient to meet the current expenses, and there is every reason to expect that before next year it will pay a moderate profit." In the same report he stated, in speaking of the lines between New York, Albany, and Boston, that their "success electrically, as well as commercially, has been beyond our ex-

pectation." Perhaps this was because, as early as March, 1885, a report of the predecessor American Bell Telephone Company confidently stated: "Conversation can readily be carried on in low tones, the speaker's voice being easily recognized." All of which augured well for the new long lines.

A telephone executive of today remarks that, to a considerable extent, the success of these old long distance lines was due to acknowledged high standards of construction and maintenance. "The lines were clear of trees, sagging wires, broken insulators, and similar faults," he points out. "There is no question but that these factors had an enormous part in our reputation for good service, built up in the days when competing forces were actively at work."

Philadelphia to Chicago

THE THIRD old timer, the line between Philadelphia and Chicago, was constructed as one project between April and December 1901. From Newtown Square, outside of the Quaker City, its 35-foot chestnut poles carried twenty copper wires as far as the test station at Dallastown, Pa., 60 miles to the west. Beyond that, only ten copper wires ran on 30-foot chestnut poles into Brushton, outside of Pittsburgh, which was reached in July. From here the same number of wires was carried on cedar poles of similar height into Morrell Park, the test and operating station outside of Chicago. By this time the iron zero wire was no longer used.

The last remaining section of the original Philadelphia-Chicago line—

Down by the Pennsylvania Railroad tracks in Baltimore, this gang paused to let the photographer record the fact that poles were really long at the turn of the century

from Marion to Logansport, Ind. — was dismantled last October.

A line crew at Hazelton, Pa., in 1910, all set for a big day's work-out

Good Old Days

THE neat reports of the Engineer's Department in New York, kept in black binders stamped in gold, reveal many details about these lines and include items unfamiliar to present-day accountants. Usually typed, but often in fine handwriting, they lay bare the anatomy of a horse-and-buggy era in telephony.

The team and driver so important to such enterprises then were usually hired, it seems, for $65 a month. There were entries as well for the "reel wagon," the "board hunter," the "dinner wagon and driver" and for shoeing many a horse. Gang leaders were ordinarily paid $35 and board a month and their men $30 and board a month—for the standard ten-hour day, six-day week, of course. Not to mention the frequent and very unstandard stretch of hours during which devoted men in a pioneer industry struggled to get the line across rocky soil, over the river, and up the hill.

Stout Fellows

"FOUR MONTHS out of the year we started out before daylight in order to be on the job at 7 A.M. Then we worked until 6 P.M. and came in after dark. That was known as the good old days," writes one member of a gang of yesteryear.

"In many ways the foreman of an early wire gang was like the skipper of an old-time sailing vessel," writes a retired employee. "Both have gone out now, but the point is: they successfully met the conditions they were up against. It must be borne in mind that [the foremen] had to rule over as hard boiled a lot of men as was ever gathered together. They could control their gangs only by being tougher, braver, more reckless, and withal better fellows than any of the men under them."

Another writer also testifies to the rough qualities of the men but adds, "Many of them would get down on their knees and make a little prayer beside their beds at night."

The brawny men who worked so indefatigably played hard too. Whenever a group of pioneers gets together there is many a chuckle over the pranks they played on each other, the horse shoes they pitched, the poker they played over the week-ends, and the dances they occasionally found in the quiet little towns

along the lines. A good uppercut relieved tension once in a while, and in some territory there was fishing and hunting and even the rarer sport of shooting rattlesnakes. The cup that cheers had its devotees too—which prompts one telephone man to characterize a particular driver as the "only fellow I ever knew who could tell from the color of a farm house and its general surroundings whether they had any hard cider in the cellar. He was seldom wrong."

Despite such occasional shenanigans, the telephone men enjoyed an excellent reputation where they worked or were stationed along the lines. "Often, when we turned up to do a job the local farmers would not allow us on their property until they were sure that it was all right with Bob X—," writes one of the ex-members of a gang. "Bob, the section lineman, was the Telephone Company in person and nothing could be done unless it was all right with him." Another states: "The children would say with great respect, 'That's Fred Y—'s line'!"

Before Earth Borers Appeared

EVERY NOTE or conversation highlights the exhausting, back-breaking labor pole-hole digging and pole setting meant before the day of modern equipment. Also, rivalry was keen—and a word of praise long remembered. One of the men still recalls an incident which occurred when he was working at Oxford, Pa., on the Philadelphia-Chicago line.

One day A. S. Campbell, Construction Superintendent of the A. T. & T. Company, and Walter E. Ainsworth, his assistant, "happened by just as I had my hole down about five feet, with my rocks in one pile and the dirt in another," he remembers. The visitors observed his use of the spoon shovel and, as they went off, Mr. Campbell remarked, "Walter, there's a mighty good hole-digger." The glow of pleasure called forth by that remark was unforgotten fifty years later.

Another writer tells of watching the New York-Chicago line being built in 1889 through Mifflintown, in Juniata County, Pennsylvania, before he worked for the company. "Many of the poles were 50 feet in length and it was a marvel how the job was handled. Every man had a certain thing to do and knew just how to do it. I have my doubts that a gang of men like that could be gathered today to work together as they did." The tools might be on the primitive side, observes a retired executive, but the skill and spirit of the men left nothing to be desired.

PERHAPS it was the difficulty of raising these wooden giants, together with the task of affixing a battery of cross-arms to them, which made each pole a separate personality to the men who reared and cared for them. Recent correspondence and older files devoted to these lines fairly bristle with the designation of poles by number, and it is obvious that these usually impersonal digits clearly suggest the faces of old friends—or enemies—whose appearance and surroundings are completely familiar.

Aside from so much hand labor, a deterrent to speedy construction in those days—and ultimately to quick trouble clearing—was the state of the roads. "Owing to the extreme bad condition of roads in this sec-

Although the gang evidently raised this 40-foot pole successfully, scarcely a man is piking in accordance with later and safer methods

tion [in Pennsylvania near Brushton] the work is progressing slowly," ends one construction report which could do for many a similar project. None too good in the best of weather, the roads became quagmires on wet days and wagons sank up to their hubs in red clay "gumbo." Construction forces which had to transport poles ranging from 40 to 90 feet in length had their work cut out for them under such conditions—even before they started raising the giants with few aids to muscle-power.

Pride in the Work

THE MEN recently involved in constructing the first coast-to-coast radio relay route will have no difficulty in appreciating the pride of those who worked to open pioneer lines in the past. Long after the facilities had become part of the plant, those concerned delighted in telling of their roles in the enterprises. In fact, a retired engineer remarked, they were not always exactly modest in such descriptions.

When this engineer was wire chief at Harrisburg, Pa., one of the general foremen dropped in and in the course of conversation casually remarked, "When I built the New York-Chicago line through Harrisburg. . . ." His host was greatly impressed until another foreman, passing through the city later on, made a similar observation. This

prompted the wire chief to turn to his boss and express his wonderment. The latter smiled and replied, "Well, it probably required several foremen to build the New York-Chicago line."

About a month afterward, his boss said, "The man who built the New York-Chicago line will be here tomorrow." The next day brought in Mr. Campbell, but in the course of an hour's talk about telephone matters he said never a word about building the New York-Chicago line through Harrisburg or anywhere else.

In the early days, the right-of-way man was more often a gang foreman than a lawyer. Most of them were appreciative of the importance of making a good impression on the public but, faced with the need of pushing the line through, some of them were not overly concerned with niceties—as the maintenance people discovered later. Occasionally, construction forces worked with thoughts of the arrival of the sheriff in their minds, and irate owners stood in newly dug pole-holes or took shotguns in hand while discussing property rights. Money was not exactly squandered by the advance agents either—to judge by many a grant through an entire property for $1.00,

A line gang, with mascot, sits for its photograph on a peaceful Sunday afternoon forty-two years ago. It will be noted that quite a few derbies were being worn then in Pimlico, Md.

or the practice of one foreman who secured a number of property rights along the New York-Chicago line for "a quarter" each.

As telephony took on a more solid footing, real live accountants were hired to take up some of the work. This had its compensations, as one foreman of a construction gang found when he complained to his supervisor that it was impossible to get his accounts straight because there was always a mistake in addition. He was told to stick to his last and not worry about such details. If he chose, he could send the accounts in a basket to those accounting boys at the office and they would take care of the rest.

The exterior of the test station at Newtown Square, Pa., outside of Philadelphia, seen in 1901—in the heyday of the cross-arm

The Old Stations

MANY OF THE reminiscences about the old days and the old lines center about certain test and operating offices which played typical or leading parts in telephone development. Their missions fulfilled, many have since been discarded.

Such was the office at Newtown Square, Pa., on two of the routes under consideration here. Originally a frame house which was the home as well as office of a section lineman, it later became a neat red brick building. Partly because of the name of the town, and partly because of the many important lines known to converge there, most visitors reached the place with the idea that they would find some imposing civic center. Confronted with such a homey scene, they inevitably inquired, "Where is the square?"

However, that homey touch underlay the formation of a celebrated volunteer fire company, enthusiastically supported by the telephone crowd and a fierce competitor for honors in the trials held among the fire companies of Delaware County. The organization was founded before World War I when a bad fire annealed all wires on the Philadelphia-Chicago line and threatened to spread to various buildings in the town.

Brushton, outside of Pittsburgh, on both the old lines running to Chicago, was another such focal point. It too began in a frame building occupied by a section lineman and his wife, who did the operating. In 1901 Brushton was distinguished by a boss who arrived daily by bicycle

after a three and one-half mile trip. Another of its distinctions was the adoption in 1910 of a high-wheeled truck, the first motor vehicle for section lineman use.

The ivy-covered station was often the scene of important experiments in telephony. Here the engineers made a number of tests at night on large gauge wires and the effects of loading them. Brushton was also one of the first repeater stations on the initial transcontinental line. Great was the interest in the first mechanical repeater installed there —and the vacuum tube repeater which ultimately replaced it.

Finally, the first experimental field testing work involving carrier systems took place at Brushton in 1916. In the fall of 1918 the first carrier telephone systems went into commercial operation between Brushton and the Tuxedo station in Baltimore.

Because of the many long-haul circuits to the west and south and the number of leased private telegraph wire services which passed through the station, its personnel was everlastingly busy testing and locating the troubles inherent in the early plant. During sleet storms it was often the haven for line and cable forces as well as "inspectors" (now equipment attendants) pressed into service in emergencies—all of whom could count on a cordial greeting and a good cup of coffee there before starting on their way again.

When it was opened in 1892, the station at Maumee, Ohio, was also the cottage home of a section lineman, who helped to build the New York-Chicago line, and his wife, who acted as operator and helped occasionally at the one-panel testboard. At the height of its activities, there were 40 employees at Maumee and a number of those who worked there became important figures in the Bell System.

In 1916 and 1917 this station was involved in field trials of carrier telephone systems over Long Lines circuits to South Bend. In 1917 and 1918 the circuits between Maumee and Morrell Park, on the edge of Chicago, were used for experiments with carrier telegraph service.

Pole 11040, a Long Lines landmark beside the Maumee office and the last survivor of the original New York-Chicago line, was taken down because of a street lighting project several months ago. For sixty years this sturdy veteran had raised its cross-arms—at one time as many as twenty-four—in this Ohio town rich in telephone lore. Now, sections of the pole are to be found in the museums of the Bell Telephone Laboratories and the Ohio Bell Telephone Company as well as in the homes of several telephone pioneers.

Largest in the World

ESTABLISHED IN 1896 and reputedly at one time the largest open wire terminal in the world, Morrell Park, the test and operating station at Chicago, played its part in the business and anecdotage of telephony for 55 years. Across a sparsely-settled area outside of Chicago could be seen poles with multiple cross-arms bringing lines from many cities. This great convergence of open wire created quite a problem for a station which for a long time was equipped with only one volt-milammeter, one

wheatstone bridge, and one log book related to clearing troubles.

These were the days when there were only three or four houses in sight and each summer an encampment of gypsies settled down about a mile away. It was also the period when the station possessed a night boy endowed with overpowering curiosity. One evening he investigated the power board to such effect that the next morning, as one of the operators put it, "we were in a terrible condition."

For some time after the opening of the long distance lines eastward, the telephone booths at the Quincy Street office within Chicago were busier offering exhibition calls than in collecting money for paid-up business. Often a cab would be sent to bring a prospective patron to the telephone office, where he was allowed a free call to a friend on the shores of the Atlantic in the hope that he might take up the new idea and telephone out of town often. After service was opened as far west as Omaha in 1897, everyone was extremely proud of the fact that the Cudahy Packing Company actually put in a long distance call *every day* from Boston to the Nebraska point. A company leaflet made quite a point of the matter.

The railroad guide at the Morrell Park station was well-thumbed. For gangs and individual linemen were often dispatched by train to points where teams and drivers could take them to a trouble spot. If the roads became too difficult for a team, the linemen would then resort to horseback. One enterprising chief testboard man at the Illinois station once engaged an auto for clearing trouble, but dropped the scheme when the livery man submitted a bill for $5.00 an hour.

Those Were the Days

IN THOSE DAYS a lineman who was as much as fifteen miles away from home at nightfall would plan to stay overnight at a farmhouse or an inn.

"The meals were good" is the unanimous report—and the prices a joy to recollect in this era. Room and three meals a day ranged in price from 75¢ to $1.00, although an occasional bargain at 60¢ could be found. Naturally, the dollar top was ordinarily reserved for some special place in a large town. In the Chicago territory, incidentally, the accepted price

The interior of the test station at Newtown Square, in 1912. This station was on both the New York–Philadelphia–Washington route and the line from Philadelphia to Chicago

was 20¢ for each meal and 20¢ for overnight—total 80¢. It took an emergency or a special situation to justify $1.00.

Dinner was usually a quarter, although one rather high class place was noted for charging 30¢. To be sure, one company account book shows that in 1902 a lineman and his driver each actually spent 40¢ for dinner along the Philadelphia-Chicago line. The pair did better in providing their horse with an evening meal for 15¢, which also gave free stabling, of course.

Meals were served country style, with all food on the table so that you could help yourself. A good breakfast meant ham and eggs, bacon, sausage, home fried potatoes, buttered toast, coffee, and occasionally even pie and cake. Dinner wasn't so niggardly—you got soup, two or three kinds of meat, potatoes, vegetables, homemade bread, cookies, various cakes, and coffee.

Beds, on the other hand, were not always good. Also, if those arriving early had been assigned to all the beds, late comers had to be content with a "shakedown," a tick with straw or corn husks laid on the floor.

Hard Going

THE COMBINATION of open wire lines, sleet, wind, cold, and the bad roads of former days often made maintenance exceedingly difficult for the plant people. "We were always glad when the storm season—from about November 15 to April 15—had passed." Even where No. 12 gauge wire had given way to the stronger No. 8 gauge and the poles were storm-guyed and so closely spaced that they looked like "hog-tight and bull-strong" fences instead of telephone lines, the problem was still extremely troublesome.

The New York-Washington route, not far from the coast, was a "headache" from New York at least as far south as Baltimore. One Bell System man recalls walking the nearby railroad tracks with his brother to bring food to a gang actually beleaguered by heavy snow.

ON THE occasion of the Taft Inaugural on March 4, 1909, the capital itself was cut off by sleet from all communication. When a pair of telephone wires was put back into service late that afternoon, one was placed at the disposal of the Associated Press and the other turned over to the Pennsylvania Railroad. During the remaining days of crisis, the telephone company used all its communication facilities into Washington during the day for the general public and the subscribers to its private line services. But when the business day ended, the lines no longer needed for business firms were employed during the night by the Western Union Telegraph Company.

The Philadelphia-Chicago route through Pennsylvania covered some pretty rough country, an ex-plant man points out, and one stretch of line over the mountains was called "the big flat" because of the many times it lay flat on the ground. The New York-Chicago line west of Harrisburg, Pa., had particularly rough going as well. Both of these routes carried important services and, in case of line failure, little re-routing

could be done without affecting the service adversely.

A man about to clear trouble would often fill up a spring wagon with the equipment thought to be needed and disappear into the distance, his office having rather vague ideas as to when he might return. It was often cold work, and the way the men prepared for the weather called forth a comment by an old Irish woman who lived near the test station at Cuyahoga Falls. "Sure, thim linemen can't git cold. They have as minny coats on as an onion." Perhaps she made her observation in

Left: This pole—#11040—outside the test station at Maumee, Ohio, was a Long Lines landmark for 60 years

Below: Down she comes! But pieces of the noted old pioneer have been preserved in telephone museums and by telephone people

1904, when the New York-Chicago line was hit by a sleet storm so bad that it practically destroyed the route along the 100 miles between Washington, N. J., and Lebanon, Pa.

Fair as Well as Stormy Days

THERE WERE, of course, fair as well as stormy days in maintenance work, days when quiet competence was the only job requirement. But a rather special day was the occasion when a gang rerouting a line near Wilmington, Del., was invited by one of the DuPonts to visit the magnificent Longwood Gardens, where refreshments were served and an organist entertained them.

There were days of high adventure too. Evidently a number of men dwell in memory on the times when they set out in row boats to repair a line—and were nearly swept over the edge of a nearby dam. Then there was the time when a couple of linemen found that the cause of trouble was a thief up a pole stealing wire while another man stood guard with a gun. And there was the exciting episode when a young fellow, looking into the cupola of a parsonage from a tall pole, saw two children starting a fire with matches. Clambering down, he corraled the family and they arrived on the scene just as the fire was making good progress and the children were screaming.

The trio of lines now taking their place in telephone company archives do not represent quite the earliest stage in long distance development. There was, for example, the pioneer line built between Boston and New York in 1884. Nor, to be sure, do they represent even any particular later stage in joining American communities by long distance. South of Washington there were long stretches of line connecting important cities in the '90s, a through link being achieved by 1900. Westward, telephone facilities marched beyond Chicago to Omaha in 1897, to Denver in 1911, and to Salt Lake City in 1913. The last pole of the first transcontinental circuit was placed on June 17 of the following year and coast-to-coast service was opened on January 25, 1915.

Nonetheless, these three lines, which present a fresh morning of telephone pioneering, have engendered reminiscence and emotion to a degree unique in telephony. The recollections of the men who built and maintained these strands of copper joining New York, Philadelphia, Washington, Pittsburgh, Chicago and many another community form vivid chapters in any tale of telephone development. In particular, they disclose warm fellowship rising out of coöperative effort in a great new enterprise and reflect the charm of a simpler America.

New Telephones for a Busy Nation

(*Telephone Story* from the Telephone Hour radio program of June 16)

There's a bright, sparkling telephone set on the table before me. Listen, I'll spin the dial for you.

We took this telephone off the production line because it has a special meaning. We're proud of it because it is the five millionth telephone to be made in Indianapolis, where a new plant was officially opened only nineteen months ago. There, Western Electric, manufacturing and supply unit of the Bell System, built a factory solely for the manufacture of telephone instruments. The plant would cover eight average city blocks; it employs more than 6,000 people. It produces telephones like the one before me at the rate of 7,500 a day. In addition, it turns out 4,500 telephone instruments of other types designed particularly for specialized uses. Altogether, more than 12,000 telephones a day! That's a lot of telephones!

But our country needs a lot of telephone service these days. That means not only new telephones going into homes and offices . . . expanding factories . . . army camps and naval bases . . . government offices and civil defense . . . but also all the vast amount of wires, cables, switchboards, and other equipment needed to connect these new telephones to all the other telephones in America.

We are working hard to meet these demands . . . to provide the best telephone service and telephone equipment possible.

And so tonight, we salute this telephone. It represents all the new telephones and new equipment developed by Bell Telephone Laboratories, manufactured by Western Electric, and operated by your own telephone company. It represents the inventive skill and manufacturing know-how of the Bell System team. It represents our constant effort to supply America with the kind of telephone service that is so important to our country today.

Ever Use a Wheatstone Bridge?

This year brings, in May, the hundred and fiftieth anniversary of the birth of a pioneer in telecommunications, CHARLES WHEATSTONE.

At the age of 21 he set up as a musical instrument maker, which led him into experimental acoustics. About 1834 he was impressed with the great velocity of electric transmission in conductors, which he himself had evaluated with some accuracy. From 1837 onwards, he worked in partnership with W. A. Cooke, who had designed a telegraph instrument, towards adopting electric transmission for telegraphy.

Wheatstone's genius was many-sided. He was a skilled cryptographer: he deciphered hieroglyphic Mss for the British Museum. He invented the kaleidophone, for demonstrating the movements of sounding bodies; he discovered the principle of the stereoscope; he read papers on the physiology of vision and devised a means of analysing metals by examining the spectra of electric sparks thrown off from them. . . .

Of a shy disposition, he yet became Professor of Experimental Philosophy at King's College, London. Governments, universities, and learned societies showered no fewer than 34 distinctions upon him, and ultimately he received a knighthood.

No one man can claim to have invented the electric telegraph, but we may honor Wheatstone as one who may be regarded as the founder of modern telegraphy.

From *Telecommunications* of the United Kingdom Post Office

Four presidents of Bell System companies who are graduates of the University of Missouri were present at their Alma Mater in Columbia, Mo., on June 5, 1952. In addition to Cleo F. Craig, President of A. T. & T., who was there to receive the honorary degree of Doctor of Laws, they were President William V. Kahler of the Illinois Bell Telephone Company, President Mervin J. Kelly of the Bell Telephone Laboratories, and President Eugene J. McNeely of the Northwestern Bell Telephone Company.

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